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HIGGINS, L. G., M.A., F.R.C.S. An illustrated catalogue of the palearctic *Melitaea* (Lep. Rhopalocera) . 175–365, 16 pls., 215 figs., 7 maps

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AN ILLUSTRATED CATALOGUE OF THE PALEARCTIC *MELITAEA* (LEP. RHOPALOCERA)

By L. G. Higgins, M.A., F.R.C.S.

With 16 Plates and 214 Figures and 7 Maps.

Manuscript received 19th December, 1940.

[Read 5th February, 1941.]

In the following account of the Palearctic species of the genus *Melitaea*, my intention is to provide a catalogue of species and forms of proved status, with adequate figures and sufficient description to make identification as easy as possible. A careful revision of the group is long overdue, but the number of closely allied species, as well as the inaccessible habitats of many, has made the task more formidable than I anticipated when my interest was first engaged nearly ten years ago. The difficulties are certainly increased by the presence of marked local and individual variability. The same variable factors recur constantly in different species, producing parallel variation of a striking kind. In the present work I have tried to isolate and describe some of the more obvious variable factors, but only the outstanding forms are fully described and named, in order to avoid confusion, and to present the entire species complex as clearly as possible. To facilitate the study of other named varieties, I have added at the end of the descriptive matter, in the case of each species, reference lists of all names applied to each insect, as far as I can trace them. This part of the work has involved a good deal of labour, and I should like to express my grateful thanks to Mr. F. J. Griffin and Miss E. Evans of the Royal Entomological Society, for their help in obtaining books and checking references.

The specific diagnosis of described forms is often a matter of great difficulty, but fortunately many type specimens are preserved in the British Museum (Natural History) at South Kensington and Tring, and by the courtesy of the authorities I have been able to make a close study of these collections. In addition Messrs. Staudinger and Bang-Haas were good enough to send me for examination a selection of " original " specimens from the Staudinger collection which contains much invaluable material. Mr. E. P. Wiltshire has allowed me to make full use of his most interesting collections from Persia and Kurdistan. Unfortunately further material from this source cannot become available under existing conditions. The collection contained one undescribed species, which will be referred to later as *M. wiltshirei*, in recognition of Mr. Wiltshire's most energetic and successful search for material from the middle East. I have also had the pleasure of examining Mr. R. E. Ellison's extensive collections from Syria and from Morocco, and permission was given to figure some of his specimens. The coloured plates have all been drawn by Miss Dorothy Fitchew with such great delicacy and skill that I believe she has successfully caught those indefinable characters of related species, which are more distinctive than the actual pattern. I am confident that all who consult this paper will appreciate the painstaking accuracy and brilliant colouring of her work. Finally I must acknowledge a special debt to Mr. N. D. Riley, who has been always

ready with his expert advice. In addition he has read the MS. and the proofs, and has shown a keen interest in the work which has been most encouraging and thoughtful.

To my regret seven forms and species described are not figured, as specimens were not available in time. It is hoped that a supplementary plate illustrating these insects may be issued at some future date.

General Characters.

The Melitaeidi form an extensive and distinct Nymphaline group. In my opinion Reuter was right in suggesting that they might properly be treated as equivalent in rank to the Argynnid and Vanessid tribes. The species are very widely distributed in Europe, Asia and America, but they do not occur in Australia or in Africa south of the Sahara. In the Old World the individuals are frequently very numerous, although the number of different species is relatively small. The egg is distinctive, somewhat higher than it is wide, and marked with a number of fine grooves, and sometimes shallow pits which recall the Argynnid structure. The larvae show the usual Nymphaline spines, which are very well developed in some groups (*Euphydryas*), and the resemblance to Argynnid larvae is very close. In other groups (*Mellicta*) the spines are short, scarcely more than tubercles. As far as is known all the larvae hibernate when quite small and pass the winter together in a silken web. In the spring the family breaks up, and in some cases a different food-plant is taken. The chief structural features of the imago are well known. The cell of the fore-wing is closed, that of the hind-wing nearly always open. The palpi are rather variable in shape, but they are always clothed beneath with long fine hairs and narrow scales, not as in *Argynnis* with bristles. The fore tarsus of the female is composed of five joints, of which the first four each carry a pair of strong bristles. The terminal segment is composed of a round knob, of which the purpose is not clear. In the male sex the fore tarsus is devoid of spines, and it is often very rudimentary; the number of components varies from one to four, and the general formation of the limb appears to have some generic value. At the end of the terminal segment is a number of very fine spines, from among which arises in many species a fine comb-like structure or a strong tooth as a terminal organ (see fig. 16a). The most remarkable character is the form of the genitalia in both sexes, which is quite unlike that of any other butterfly known to me. They are hard cylindrical structures, which can only be mounted for microscopical examination in a cell of some depth. The claspers must be detached to obtain a lateral view of the harpe, and they are then most difficult to mount for comparison, as a small degree of rotation will alter the apparent shape entirely. The great focal depth required makes these objects unsuitable for photography, and I have therefore made camera lucida drawings of the genitalia and other anatomical features. These are all drawn to the same scale, and by this method it is possible to emphasise those details which are important. In the perfect insect, the wing-pattern is remarkably constant, and often persists with the least possible modification through large specific groups. On this account it will be found that specimens of different species similarly modified will often resemble one another much more closely in most respects than do examples of the same variable species which are differently modified. In nearly all cases the upper surface of the wings is some shade of yellow or orange-brown, crossed by series of black spots or linear markings.

Natural Divisions.

The species fall very naturally into two main groups, and no intermediate forms are known at present. In the first group, which has been separated by Scudder as *Euphydryas*, nervure X of the fore-wings usually arises at or before the apex of the cell. The insects are heavily built, with a characteristic wing-marking. The fore legs are strong and thickly clothed with hair. The male and female genitalia have a characteristic shape, the latter much nearer to *Argynnis*, and entirely unlike any member of the second or typical Melitaeine group. The species of *Euphydryas* are all single brooded, although in suitable localities the imago may emerge early in the year. The egg is known in a few species only. In these it is ribbed for about half the distance from the apex to the base, which is smooth. The larval spines have probably a distinctive arrangement. This genus is strictly confined to the holarctic region in its temperate districts. It includes such characteristic European species as *maturna* Linn. and *aurinia* Rott. The species are not very numerous, are often very closely allied, and show a strong family likeness. The specific differences are frequently slight, but, when these are appreciated, the species are found to be stable and perfectly differentiated over a wide area. Some have an enormous distribution. They are found under very diverse conditions from sea-level to the highest limit of ordinary vegetation, but seem able to exist only under the optimum conditions of life. They are consequently among the most rigidly localised of all butterflies. It is interesting to note that near allies of the European *maturna* occur in North America. On the other hand, the typical or Melitaeine genera of Europe and Asia are not represented in America, except possibly in the Arctic tundra of the north-east.

The second main group of typical Melitaeine species forms a much less homogeneous series. They all differ from *Euphydryas* in that nervure X of the fore-wing arises beyond the apex of the cell. The palpi and fore legs are less hairy, the latter slender and often much atrophied. The genitalia of both sexes are very variable, but always of quite a different plan from those of the Euphydryad species. The egg is known in a few cases, and the ribs extend from the apex to the base or the latter is marked with rows of small pits (*Phyciodes tharos*). The larval structure is recorded in very few species. Many of these butterflies produce two, or possibly three, annual broods, provided the conditions of life are favourable. It is possible that all are potentially double-brooded, and in this respect they differ widely from those of the Euphydryad group. The species of *Melitaea* spread far to the south. They extend in Europe and in Asia to the southern limit of the Palearctic region, but they do not enter the tropics. The ability to tolerate hot and dry conditions is particularly noticeable in the *didyma* group, some members of which are found in the northern Sahara, in Arabia, Baluchistan and other desert regions. The species of *Mellicta* are more at home in a cooler climate, and a form of *M. athalia* Rott. extends far within the Arctic circle in Europe and probably in Asia also. In America the position is different. Species of *Euphydryas* are distributed over North America and extend southwards along the Rocky Mountains as far as Mexico. On the other hand, the more typical Melitaeine genera including *Eresia*, *Chlosyne*, *Phyciodes* and others are among the most characteristic insects of the tropical fauna on both sides of the Equator. Indeed, it is here that the group attains its maximum development, and the very large number of species rapidly diminishes both north

and south of the tropical forest belt. The American species frequently diverge from those of the Old World in another respect. In many tropical forms the wing-pattern loses its monotonous stability, and there is great diversity both in pattern and colour. Other species show marked mimicry of the Ithomiine and Acraeine butterflies with which they fly; others again present striking polymorphism. The typical genus *Melitaea* is represented by the American species of the *palla–acastus* series. These may be placed in a separate group, between *cinxia* and *phoebe*, and allied to both.

Genitalia Described (fig. 198, p. 354).

The divergence of the Melitaeid genitalia from those of other butterflies is so great that a few new terms must be introduced for structures which cannot be homologised with certainty in other insects.

Male. The male organs have been described at some length by Dampf (1910, *Iris* **23** (Beih. 2)) and in particular by Suschkin (1913, *Z. wiss. InsektenB.* **9** : 169). In the present work I have adopted as far as possible the terminology suggested by McDunnough (1911, *Canad. Ent.* **43**) which is comprehensive and widely recognised. There is wide variation in different genera in details, but the following account will indicate the characteristic features of the whole group. I hope this short description will be easily understood if reference is made to the figure on p. 354, where all structures are clearly marked.

The most striking peculiarity is probably the massive ninth ventrite completely chitinised to form a *ringwall* which is often grooved above for the passage of the penis. The ringwall is excavated on each side to form the inferior margin of the opening through which the body cavity communicates with the interior of the clasps. Immediately behind this opening the lateral or superior margin of the ringwall is produced upwards and backwards into a small process which I term the *condyle* (" Seitenfortsatz der Ventralplatte "; Suschkin *loc. cit.*), a very obvious structure in some groups, from which muscular bands appear to pass inwards towards the penis and downwards into the cavity of the clasp. In some cases the lateral margin of the ringwall, continuous with and posterior to the base of the condyle, is rolled inwards and produced backwards as a tongue-like structure, which I call the *lingula*, to overhang the penis-groove which may be completely closed dorsally in this manner.

The *saccus* is usually bifid, and the two divisions may be widely separated, but occasionally it is single. It is formed by an invagination between the eighth and ninth sternites, and in my opinion it is doubtful whether this is really the homologue of the long, slender saccus found in *Apatura* and its allies. The ventral extremities of the *vinculum* are far apart, rigidly connected by the ringwall.

In palearctic forms the *uncus* is absent. Its place is taken in many species by a backward process from the wide flap which is often present on each side below the tegumen. In some forms (*didyma*), these lateral flaps are folded and approximated below the tegumen to form a channel for the anal gut (" analkegel "; Suschkin *loc. cit.*). The whole structure of lateral flap and process corresponds very closely with the *scaphium* of other genera, and I refer to it by this name.

The *claspers* are hollow cylindrical structures, ovoid or roughly quadrilateral in shape, and very strong and horny. There is a well-marked posterior process, above which is a tuberculated area provided with numerous bristles

and, not infrequently, showing one or more sharp spines and irregular prominences. The *harpe* is usually large and well developed, often furnished below with a row of elaborate teeth.

The *penis* is straight or curved, and provides many valuable characters. Anteriorly for nearly half its length the dorsum is wanting. The gap thus formed provides for the entry of the ejaculatory duct, and it is further closed by muscles. Posteriorly the ostium penis is usually deepened and hidden on each side by a fine, almost membranous *ostium fold*, which is often wrinkled and armed with fine teeth. In some species a small dense spiny structure, which I have called the *morula*, can be seen above the fold. Its shape provides good specific characters in some cases. The dorsal crest of the penis extends backwards in *Mellicta* as a definite mid-line structure posterior to the ostium folds, forming the *ostium keel* (Suschkin), which is actually part of the eversible membrane. In other cases the penis may terminate abruptly in an upturned apex.

I think it cannot be doubted that the structure of the genital organs gives important information regarding the correct grouping of species which are so uniform in other respects. The specific characters are not always obvious, and care is required to identify distinctive features. There is often marked individual variation, which in some cases certainly has a geographical significance. The local peculiarities in the male genitalia are not as a rule associated with a corresponding change in the external characters.

Female. The genital armature of the female is highly differentiated. It varies widely and appears to me to be of great value in separating the different groups. In the following description I have been obliged to coin several terms for different parts for which I have been unable to discover any recognised names.

In *Euphydryas* the structure is simple and greatly resembles the parts as they are found in *Brenthis*. The VIIIth and IXth ventrites are thickened over a quadrilateral area to make a *genital plate* in the centre of which is the *ostium bursae*. This horny area, which is devoid of scales, is raised into low prominences on each side. The ostium leads into a short and wide chitinous canal which I term the *antrum*, with which are articulated a pair of divergent horny rods, which enter the bursa and appear to support it within the body cavity. I refer to these rods as the *bacilli*. The bursa itself is rounded and its wall is armed with minute spines arranged in two areas near the fundus. It appears to be intimately connected with the antrum by a short neck from which arises the seminal duct.

In the more typical or Melitaeine genera the female armature is much more complicated. The very dense and horny genital plate is thrown into a strong fold which stands out externally from the body in many species and overhangs and conceals the ostium. The posterior segment of the ventral plate (IXth sternite) forms in many species a wide smooth area which I call the *scutum*. The ostium leads into a large cavity, roughly semicircular in shape, with horny walls, which appears to represent the antrum. It seems to be formed by an invagination of the cuticle within the VIIIth body segment. Anteriorly the antrum forms a blunt cone, with which are articulated the bases of the bacilli. In the *didyma* group these are partly or completely fused, in which case a single bacillus only can be seen. Smaller invaginations which I have called the *auricles* arise from the VIIIth ventrite on each side of the genital plate, and extend medially dorsal to the antrum. Not uncommonly they meet in the midline when they are separated by a longitudinal

sulcus always clearly visible, at the posterior extremity of which, but on a lower plane, will be found the ostium ductus bursae. The little pits marking the orifices of the auricles externally can be seen easily in the dried specimen when the parts are cleaned of scales. The bursa copulatrix is round (*Mellicta*) or oval (*Melitaea*). There is an extensive spiniferous area on each side (fig. 31a).

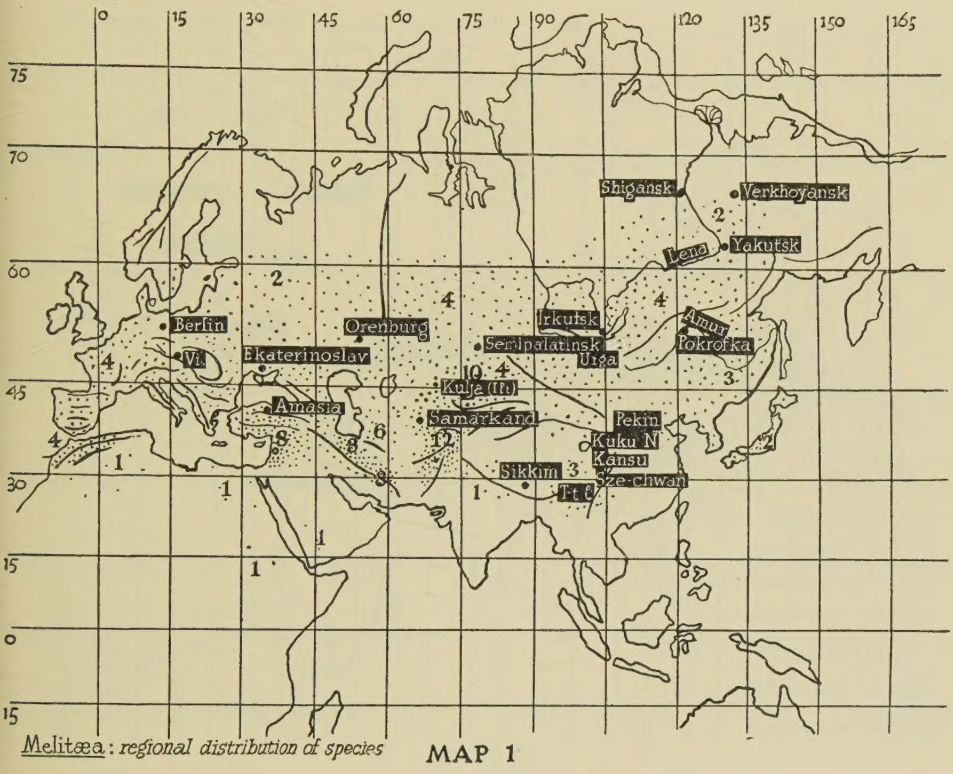
It is far from easy to grasp the relationships of the complicated foldings of the genital plate in these insects. The description given above includes the essential features as far as I can make them out. It is to be hoped that someone with laboratory facilities will soon investigate the anatomy of these peculiar structures.

Distribution in Europe. (Maps 1, 2, 4, 6, 7.)

Europe possesses an unusually rich and well-characterised Melitaeid fauna, represented chiefly by the genera *Mellicta* and *Euphydryas*, which scarcely penetrate to central and south-western Asia. On the other hand, the characteristic Asiatic forms of *Melitaea* are represented by a few common and widely distributed species, of which *aetherie* Hb. alone is peculiar to Europe. The Asiatic *M. arduinna* just enters the region in southern Russia and along the Black Sea coast, while *M. trivia* W.V., the remaining Asiatic species, extends from Russia up the Danube basin, and appears in isolated colonies across southern Europe from Bulgaria across northern Italy, Spain and Portugal. The western European species extend in diminishing numbers but with very little variation through Russia and western Siberia as far as the Altai Mountains, at which point the fauna changes without any obvious reason and the insects of the eastern Siberian fauna begin to appear. Two species only, *M. didyma* Esp. and *M. phoebe* W.V., extend farther east. Although material is very scanty, it appears probable that these two insects spread along a narrow strip of country through Mongolia as far as the Amdo in the case of *didyma*, and to the Chinese province of Chi-Li, where true *phoebe* is not uncommon. These western insects are therefore interpolated between the Thibetan and Siberian regions, in neither of which do they occur. At present there is a gap between the known distribution of both these insects in Dzungaria and their appearance again in the Amdo and Chi-Li. The species *yuenty* Ob. and *agar* Ob., now isolated in south-western China, may represent a further extension of the same fauna along the same path. An alternative route of penetration would be from the Amur along the Kingan Mountains, but this route appears less probable, as *didyma* does not occur in Transbaicalia. In the south-east the European fauna reaches the Caucasus and Asia Minor, while in the south the Mediterranean Sea constitutes a natural boundary, crossed by only a few forms which have reached the mountains of northern Africa. In the far north a single species, *Euphydryas iduna* Dalm., is found within the Arctic circle. It has a wide circumpolar distribution, appears commonly in the Altai and Sajan mountains, and has lately been discovered in the Caucasus. *E. cynthia* may possibly represent this species in the European Alps. With this exception the concentration of species in south-western Europe is very marked. It is scarcely too much to say that in this district may be found every species which is characteristic of the European region, a total of about eighteen. In addition there are two well-marked subspecies. The forms inhabiting the European lowlands usually show a very wide range, extending across the entire continent into Siberia. Such species include *aurinia* Rott., *maturna* Linn., *athalia* Rott., *aurelia* Nick., *diamina*

Lang (*dictynna*), *cinxia* Linn., *phoebe* W.V., and *didyma* Esp. The remaining European species are all found in the Iberian peninsula or in the high Alps, two extremely interesting localities in which closely allied but specifically distinct (? relict) forms occur in association with the more widely distributed insects. It is noteworthy that no species is known which is peculiar to eastern Europe, Russia or western Siberia.

No fewer than four species and one subspecies appear to have their centre of distribution in Spain. These include *aetherie* Hb. and *desfontainii* Godt., found in northern Africa and southern Spain, the former also in Sicily; *deione* Hübn.-G. and *parthenoides* Kef. found also in southern France and locally in

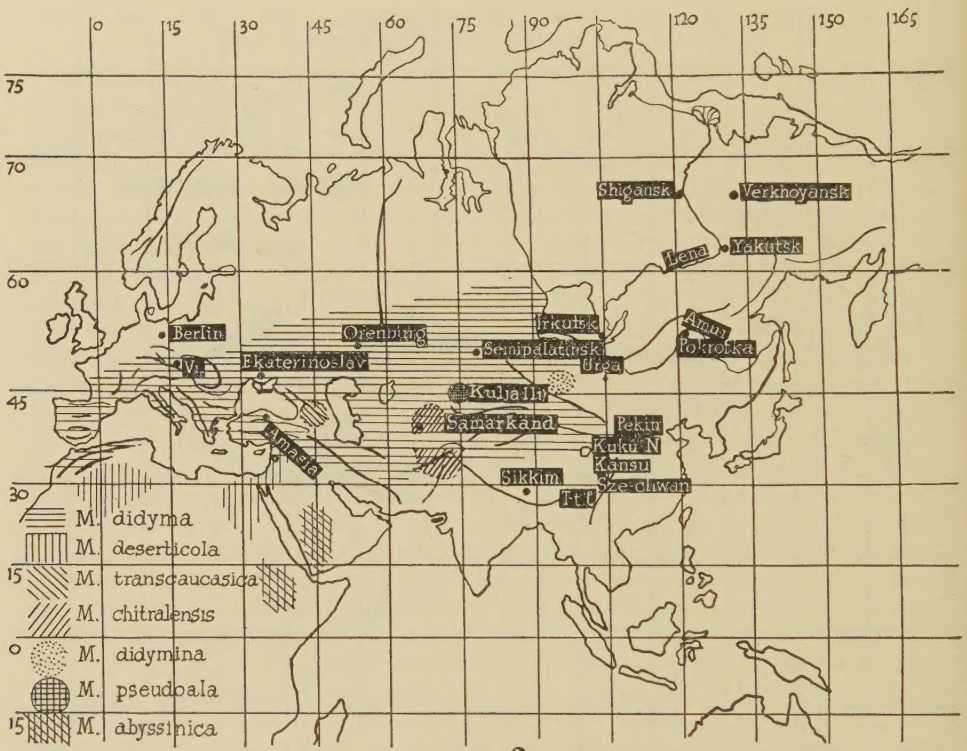


Melitæa: *regional distribution of species* **MAP 1**

western Switzerland. *M. deione*, which extends to Morocco, spreads eastwards along the southern slopes of the Alps, at least as far as Brixen, while *parthenoides* extends northwards along the Jura into Franconia and has altogether a more extensive distribution. Finally *athalia pseudathalia* Reverdin, separated as a possibly distinct species by Reverdin, is found all over south-western Europe, replacing the typical *athalia* Rott. It is only to be distinguished by the genitalia of the male, which, although locally variable, are well differentiated in the extreme south. The distribution of this form will be referred to again. It is of exceptional interest, as it appears to coincide in a general way with the distribution of other marked subspecies of European butterflies and clearly has some special significance. I should like to recall the fact that the near allies of these five Iberian insects are European and Siberian. This

is rather surprising as so many of the characteristic Spanish butterflies show affinity to those of central Asia. It is worth notice also that Melitaeid butterflies are completely absent from the Azores, Corsica, Sardinia and the Balearic Isles.

The chain of the Alps also provides four characteristic species and one subspecies. These insects are all closely related to the common forms of Europe and western Asia. They include *cynthia* Hb. widely distributed over the whole Alpine system, extending east to the Rilo Mountains of Bulgaria but not known to occur in the Pyrenees. Another related species *wolfensbergeri* Frey is found in a few localised flight places in the central and southern

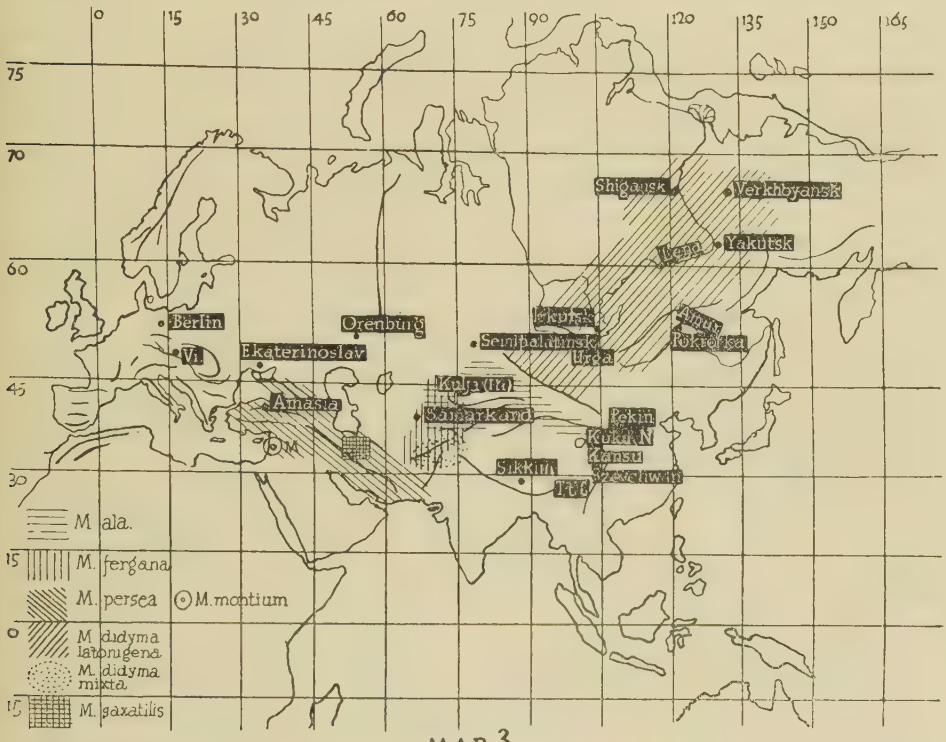


MAP 2

Alps. It is often regarded as a form of *maturna* Linn. but this is an error as *wolfensbergeri* is quite distinct, and should be associated with *intermedia* Men., which is a scarcely separable form widely distributed in the Altai and eastern Asia north of Mongolia.

Another member of the genus *Euphydryas* is *glaciegenita* Vrty (*merope* Prunn.) which is found throughout the Alps and also in the eastern Pyrenees. A majority of authors treat this insect as a subspecies of *aurinia*, and I have satisfied myself that this is correct. In addition there are two species allied to *athalia*. These are *varia* M.-D. which has a distribution similar to that of *aurinia glaciegenita*, but which does not occur in the Pyrenees although it extends to the Apennines; and *asteria* Frr. which flies very locally in the central Alps from Chur to the Grosser Glockner, but which is probably absent

from western Switzerland. With the exception of the sub-alpine *wolfensbergeri* (and possibly of *cynthia* in some localities), these are all true alpine insects flying always above the tree limit. Perhaps on this account they are absent from the mountains of central France west of the Rhone valley, and from the Jura, the Vosges, the Silesian ranges and from the Carpathians including the High Tatra. The diversity of *Euphydryas* forms found in the Alps is very marked. Although the genus is distributed across the entire northern hemisphere there is nowhere else, as far as I know, where so many species are assembled together. An obvious relationship to the fauna of eastern Siberia is again apparent. This is particularly well illustrated by



MAP 3

wolfensbergeri and it is also probable that *glaciegenita* can be associated correctly with *aurinia asiatica*, or *bang-haasi*, small insects which fly in the Altai and Sajan mountains.

One other European species *aureliaeformis* has been defined by Rocci and Verity in recent years. This insect is related to *aurelia* and even more closely to *centralasiae* Wnu. of the Sajan and Kentei mountains, with which it may be conspecific. The insect has been taken only in Italy near Turin and Milan, and possibly also in Rumania. It is without doubt a distinct species, but the distribution is almost unknown at present.

The following species are characteristic of the European region :—*Mellicta athalia* Rott.; *Mellicta athalia pseudathalia* Reverdin; *Mellicta aurelia* Nick.; *Mellicta deione* Hübn.-G.; *Mellicta parthenoides* Kef.; *Mellicta varia* M.-D.;

Mellicta asteria Frr.; *Mellicta aureliaeformis* Verity; *Melitaea cinxia* Linn.; *Melitaea diamina* Lang; *Melitaea didyma* Esp.; *Melitaea phoebe* W.V.; *Melitaea aetherie* Hb.; *Euphydryas maturna* Linn.; *Euphydryas aurinia* Rott.; *Euphydryas aurinia glaciegenita* Verity; *Euphydryas iduna* Dalm.; *Euphydryas intermedia wolfensbergeri* Frey; *Euphydryas cynthia* W.V.; *Euphydryas desfontainii* Godart.

In addition there are two species that belong to the central Asiatic group :— *Melitaea trivia* W.V.; *Melitaea arduinna* Esper.

Distribution in North Africa. (Maps 1, 2, 6, 7.)

It is convenient to recapitulate the distribution in northern Africa, although this has been referred to above. The region is closely connected with southern Spain, and the two characteristic Andalusian species, *E. desfontainii* and *M. aetherie*, occur in the more temperate and mountainous districts of Morocco and Algeria. On the other hand, one species common in Spain, *M. parthenoides*, is unexpectedly absent, although the conditions of life should be quite suitable. *M. aetherie* is rather widely distributed at moderate altitudes in a form which shows only climatic modification, and *M. didyma* also occurs commonly in non-desert localities. The form *mauretanica* Ob., which appears in very hot districts, may be possibly a poorly differentiated subspecies. *M. cinxia* and *E. aurinia* are known from a few localities in the Grand Atlas and Middle Atlas, and the specimens are similar to those from Spain. *M. phoebe* is distributed rather sparsely in mountainous districts, and appears in Algeria in the small form *punica* Ob. Farther west, in Morocco, the specimens may be much larger, but the facies remains quite distinct. This form is an isolated development which can only be ranked as a subspecies. *M. deione nitida* Ob., the only representative of the genus *Mellicta*, is another well-differentiated form which is usually placed as a subspecies of *deione*. As far as I know, it has been found in one locality only! All these butterflies occur in the more temperate climate north of the Sahara, and they represent the European fauna. In the foothills along the northern border of the desert occurs *M. deserticola* Ob. This species, which has an extensive distribution from Morocco to Syria, penetrates the desert for at least 500 miles from the Mediterranean coast. It is found also in Egypt. *M. deserticola* is clearly an Asiatic element analogous to *Cigaritis*. Finally another Asiatic element, *M. abyssinica* Ob., closely allied to *deserticola*, is known to occur in Abyssinia.

The following species represent the European fauna in Africa :—**Euphydryas desfontainii* Godt.; *Euphydryas aurinia* Rott.; *Melitaea aetherie* Hb.; **Melitaea phoebe punica* Ob.; *Melitaea didyma* Esp.; *Melitaea cinxia* L.; **Melitaea deione nitida* Ob.

The forms marked with an asterisk are peculiar to Africa. In addition the central Asiatic region is represented by *M. deserticola* and *M. abyssinica* Ob.

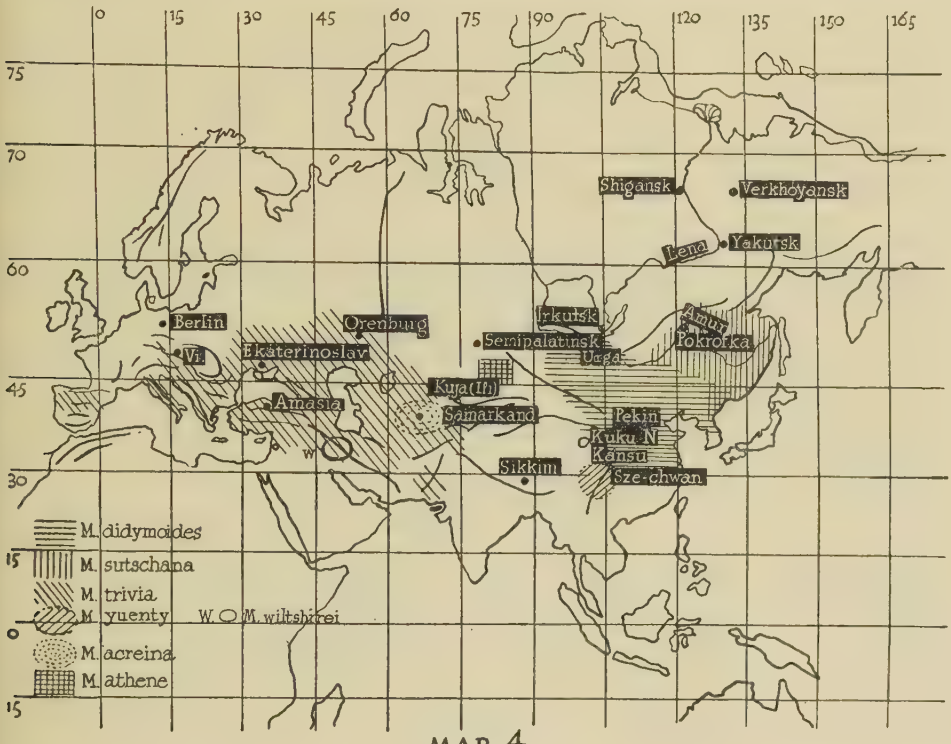
Distribution in Asia. (Maps 1, 2, 3, 4, 5, 6, 7.)

Whereas in Europe there is but a single distribution centre, the situation in Asia is much more complex. Three distinct distribution zones can be distinguished which show surprisingly little overlap. They may be summarised as follows :—

1. An East Siberian zone which extends roughly from the Yenesei River and the eastern Altai Mountains to the Pacific, including northern China and Japan. The western boundary of this zone remains rather obscure on

account of the scarcity of material from the Yenesei district, but the fauna is already well developed around Lake Baical. The southern boundary extends to the mountainous regions in the north of Mongolia. The dominant genera are *Euphydryas* and *Mellicta*, but considering the large area of the district the number of known species is relatively small. None is yet known in which the distribution is extremely localised, as is so often the case in the rarer European forms, and the main feature noticeable is the wide distribution of relatively few species.

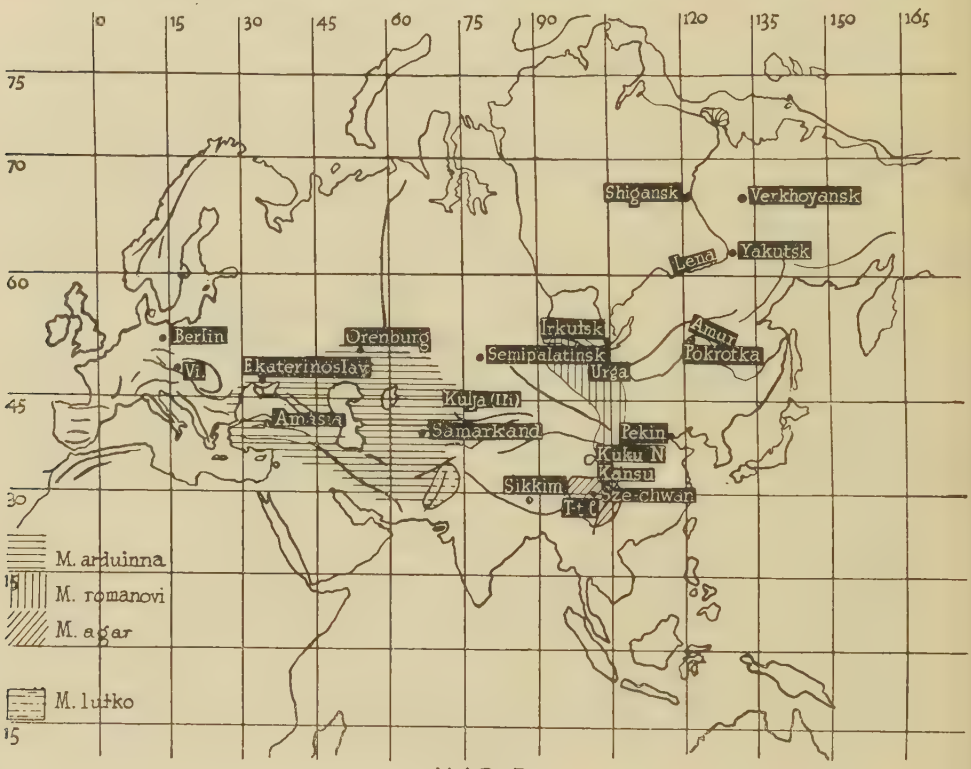
The eastern Siberian forms comprise eight endemic species and four subspecies which are also represented in Europe. These include four species of



MAP 4

Mellicta :—*ambigua* Men.; *plotina* Brem.; *seminigra* Seitz; and *mongolicola* Verity; all of which occur over a wide area from the eastern Altai or Sajan mountains through the provinces of Transbaicalia and Amur to the Pacific. A similar distribution is found in *didymoides* Ev. and *sutschana* Stgr., although I have not seen the latter from any locality west of the Amur valley. Another small *Mellicta* very like *seminigra* is found in the Altai and Sajan mountains, and seems to have a restricted distribution. The status of this form is difficult to determine, and it may represent the European *athalia* in this region. The very handsome *M. scotosia* Butl. appears only in the most eastern districts, and with *diamina* and *ambigua* it crosses the China Sea to appear in Japan. The remaining forms are all subspecies of common western insects. They include *M. diamina regama* Fruhst., which shows almost the same distribution

as *scotosia*. These two butterflies must be connected in some special way to explain this fact. On the other hand, *M. didyma latonigena* Ev., which replaces the typical form over a wide area eastwards from the Altai, does not appear in the south-east of the region. Lastly, two subspecies of *Euphydryas* occur, *intermedia* Men. and *aurinia davidi* Ob. The former extends eastwards from the Altai Mountains, while in the Changai Mountains *aurinia davidi* is already well developed, and both insects become commoner farther east, but they are confined to the mainland. In view of the presence of closely related forms in North America, it is strange that no representative of *Euphydryas* is yet known from Kamschatka or from the other north-eastern districts. In

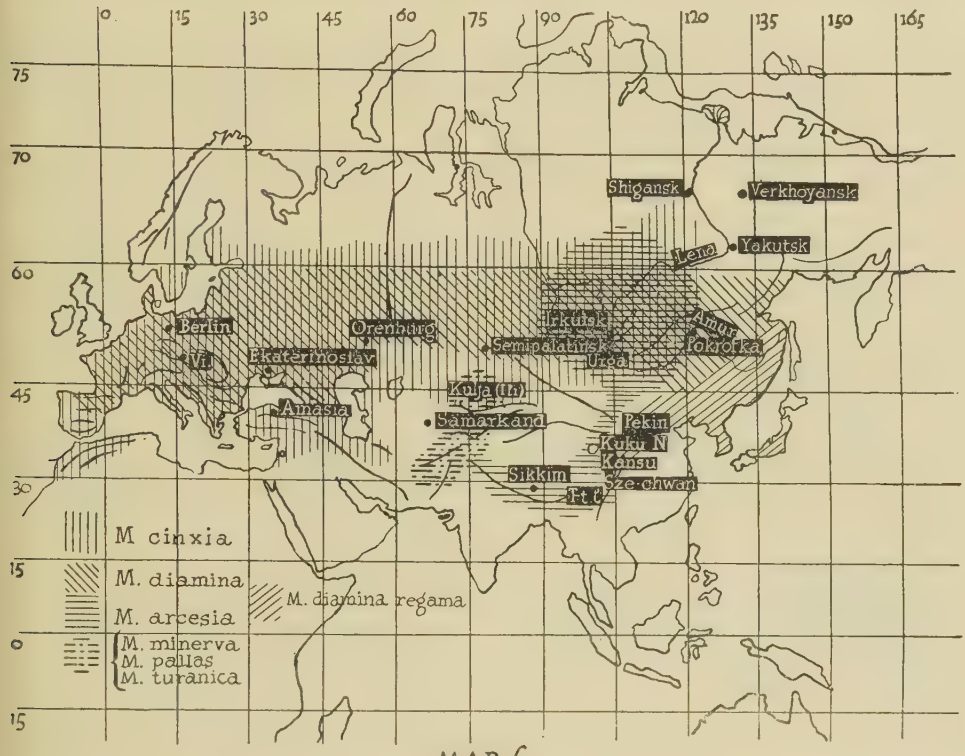


MAP 5

addition to the above, eastern Siberia is penetrated, at various points, by species of the neighbouring regions. The Arctic *E. iduna* Dalm. is common in the Altai and Sajan mountains, and typical *cinxia* and *phoebe* both enter the district from the west and penetrate in a northerly direction as far as Verchojansk. The Tibetan *arcesia* enters Siberia in the region of Lake Baical, and an anomalous form *romanovi* Gr. has been reported from several localities along the Tibetan–Siberian boundary of Mongolia.

This short sketch will indicate the principal features of the Melitaeid distribution in eastern Siberia. It is necessarily incomplete since nearly all the available material comes from the Altai, Kentei and Sajan ranges and the reaches of the Amur and Ussuri rivers. Practically nothing is known of

the wide regions extending northwards to the Arctic circle which certainly contain a Melitaeid fauna not yet represented in English collections. The presence of the western *phoebe* and *cinxia* in Verchojansk suggests a possible extension of the western fauna in a northerly direction, while the Siberian forms are more fully developed farther south along the Amur basin. It is at least clear that an enormous area in eastern Siberia is inhabited by forms which show the closest relationship to those of Europe but which remain usually quite distinct. The two insects *M. scotosia* and *diamina regama* and possibly also *sutschana* are confined to the more eastern districts including the Ussuri, north China, Corea and Japan. This is an area of particular

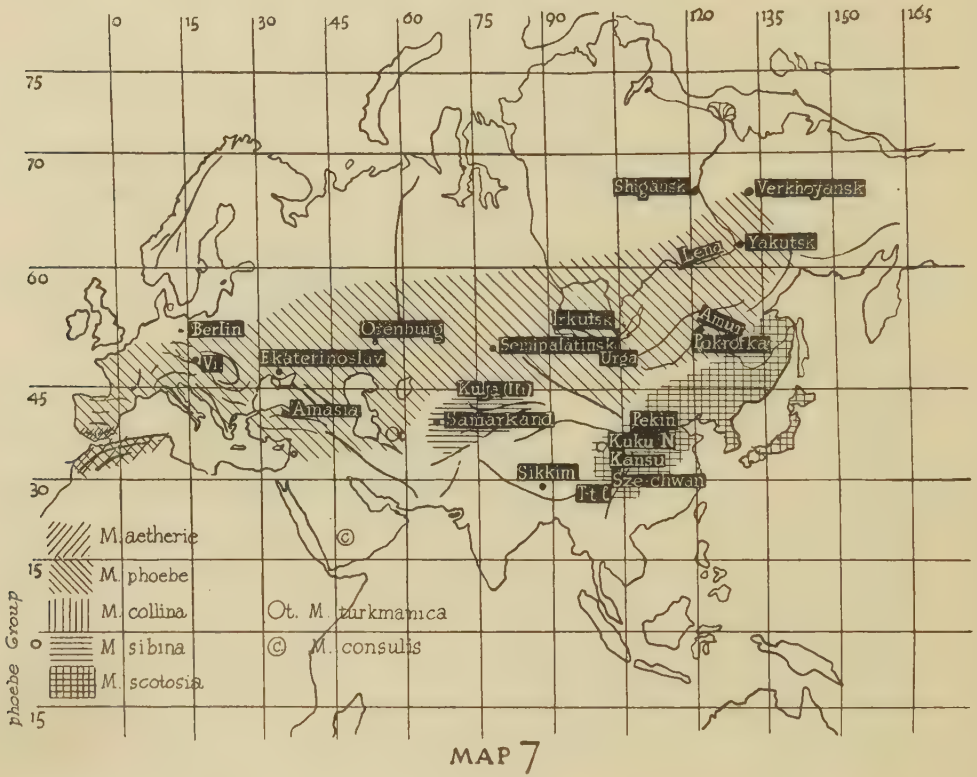


MAP 6

interest and it has been suggested that it represents a refuge-area of Angara forms displaced by the last glacial period. There is no doubt that this region exhibits a fauna of most outstanding character. It is remarkable in producing large and luxuriant races not only of the three butterflies just mentioned but also *didymoides pekinensis* and the typical form of *M. ambigua* are both much larger than western specimens of the same species.

Vicarious forms. The relationship between the faunas of Europe and of eastern Siberia provides unusual features which scarcely exist between the faunas of the other Palearctic sub-regions. The European species rarely occur in eastern Siberia, but in many cases their place is taken by closely allied forms which can be recognised at once as the representatives of familiar

western butterflies. Such forms are complimentary or vicarious, and many examples of their occurrence in these two areas have been recorded (*cf.* Reinig, 1937, *Die Holarktis* : 11). There can be few groups in which the phenomenon is so complete as in the Melitaeid butterflies. The differentiation of the oriental vicariants varies from weakly marked subspecies to others which appear to show full specific status with constant differences in the genitalia. In the latter section must be placed *M. ambigua*, replacing the western *athalia*, and *seminigra* which represents *aurelia*. The butterflies are quite distinct and although the distribution areas are not accurately known it is probable that they approach without overlapping, and that the western and eastern forms



MAP 7

nowhere come into very close relationship, and transitional forms are not known. In the same category but less differentiated is *M. scotosia*, which replaces *phoebe* in the Mongolian region and which certainly comes into close relation with the western prototype. Two extremely interesting butterflies are *M. mongolicola* Vrty and *E. intermedia* Men., representing respectively *M. aureliaeformis* Vrty and *E. intermedia wolfensbergeri* Frey. Both appear in the Altai Mountains extending east to the Pacific, and show so little differentiation that it is not easy to separate them from the western forms. In spite of this the distribution is remarkably discontinuous. As far as is at present known the Asiatic *intermedia* is separated from the nearest known *wolfensbergeri* in the European Alps by about 2000 miles, but it is likely that colonies of *aureliaeformis* may occur in eastern Europe and western Siberia.

In the case of *aurinia davidi* and *didyma latonigena* the position is very different. In both insects there is a transitional region at about the 90 deg. of east longitude where the western form is rapidly modified into the eastern subspecies. While *latonigena* shows the same subspecific features throughout its whole range, *davidi* is much more variable. Its characters probably depend partly upon climatic conditions, and on the lower Amur the species presents quite a different facies. Lastly in the extreme east *diamina* produces the very striking vicariant form *regama* Fruhst. which shows several minor characters in the male genitalia.

The following forms are characteristic of the eastern Siberian region. In the list I have indicated the corresponding western forms when they occur, and also the western limit of the eastern vicariants.

European	East Siberian
Mellicta athalia Rott.	*Mellicta ambigua* Men. Sajan Mts.
Mellicta aureliaeformis Vrty	*Mellicta mongolicola* Vrty. Sajan Mts.
Mellicta aurelia Nick.	*Mellicta seminigra* Seitz. East Altai.
Melitaea phoebe W.V.	*Melitaea scotosia* Butl. N. China.
Melitaea diamina Lang	*Melitaea diamina regama* Fruhst. West China.
Melitaea didyma Esp.	*Melitaea didyma latonigena* Eversm. East Altai.
Euphydryas aurinia Rott.	*Euphydryas aurinia davidi* Ob. Changai Mts.
Euphydryas intermedia wolfensbergeri Frey	*Euphydryas intermedia* Men. Altai.

The following are not represented in Europe :—*Mellicta plotina* Brem.; *Melitaea arcesia* Brem.; *Melitaea didymoides* Eversm.; *Melitaea sutschana* Stgr.

2. The Tibetan region includes the Chinese province of Szechuan, the Tibetan tableland and the Himalaya. In the south and east a natural boundary is present in the tropical plains of India and of south-eastern Asia. In the west the region extends as far as Kashmir, where the fauna changes abruptly. *M. arcesia* Brem. is the characteristic species, and the western *arcesia balbita* Moore does not appear west of the Indus valley, which may well indicate a zoo-geographical divide. In Chitral and Hunza the Pamir fauna appears. In the north the limits are less well defined by the Mongolian desert, but the characteristic species *arcesia* passes to the north-west of these and reappears as a rare and local insect in the south-east Altai and Sajan mountains, and in the region of Lake Baical, where it penetrates the Siberian region as far as the Vilui river.

In the extreme south-east of this area, far removed from their nearest allies, occur two somewhat anomalous species, *M. agar* Ob. and *M. yuenty* Ob., whose restricted habitat is situated at the limit of distribution of Melitaeid butterflies in this direction. With these exceptions the whole of this great district is populated only by *arcesia* Brem. and by a group of very closely related forms (*bellona*, *jezabel*, *sindura* etc.) which appear to me to form a series of subspecies with great variation in size and wing-marking but without any specific distinctions. This group alone inhabits the Himalaya and it is scarcely too much to say that each section of the range has produced a characteristic form. Such forms are often very distinct, but in the case of *bellona*, *jezabel*, *sikkimensis*, *sindura* and *tibetana* the series appears to be continuous. It is probable that further material may show this to be the case throughout the series, although the western forms seem rather more completely differentiated.

3. The central Asiatic region is chiefly characterised by steppe and desert country, although it contains some of the highest mountains in the world.

The region is remarkably well defined. On the north it is limited by the plains of Dzungaria and of Turkestan. In the east it includes the great mountain ranges of the Thian-Shan, the Pamirs and the Karakorum, beyond which the parched hills of Afghanistan and Baluchistan can support only a meagre desert fauna which resembles that of western Asia. Farther west the region extends across Persia to Syria and meets the European fauna in Asia Minor and the Caucasus. From Syria at least one species, *M. deserticola* Ob., extends in the desert area across northern Africa to Morocco. In the north of the region *Mellicta alatauica* Stgr. flies in the Ala-tau mountains and *E. alexandrina* in the northern Thian-Shan. These two species may be regarded as outlying representatives of the Siberian fauna. With these two exceptions the Melitaeid fauna of the region is composed exclusively of the genus *Melitaea*, which is represented by about 28 species. There is therefore a strong contrast with Europe and eastern Siberia, in which that genus is not particularly well represented. A further contrast between central Asia and Siberia is provided by the large number of very localised and often anomalous species appearing in the former area, suggestive of a fauna of great antiquity. The mountain and desert faunas are naturally quite distinct and must be dealt with separately.

In a comparatively small district comprising the Pamirs, the Alai and western Thian-Shan, with such related ranges as the Ala-tau and the mountains in the Kuldja district, no fewer than 15 species occur which are peculiar to this region. Seven other species, representing the fauna of the lowlands, occur on the plains and among the foothills at the base of the mountains. The district, therefore, is even more richly populated with Melitaeid butterflies than is western Europe (18 species), although the two areas are of approximately equal size. This rich fauna includes the anomalous form *lutko* Evans, which has a restricted habitat in Chitral and Baluchistan, flying there at the extreme limit of Melitaeid distribution and quite analogous in this respect to *agar* and *yuenty* of the Tibetan region.

The following species are characteristic of the central Asiatic mountain zone :—

1. *Melitaea didyma mixta* Evans.
2. *Melitaea chitralensis* Moore.
3. *Melitaea pseudoala* Sheljuzhko.
4. *Melitaea ala* Stgr.
5. *Melitaea fergana* Stgr.
6. *Melitaea lunulata* Stgr.
7. *Melitaea ambrisia* Higgins.
8. *Melitaea shandura* Evans.
9. *Melitaea infernalis* Groum.
10. *Melitaea minerva* Stgr.
11. *Melitaea pallas* Stgr.
12. *Melitaea turanica* Erschoff.
13. *Melitaea sibina* Alpheraky.
14. *Mellicta alatauica* Stgr.
15. *Euphydryas alexandrina* Stgr.

Of these *pseudoala*, *infernalis* and *shandura* appear to be very rare and local.

The wide steppe and desert region extending north and west of the central Asiatic mountains, and including Dzungaria, Turkestan, Transcaspia, Persia, Iraq, Syria and Palestine, is chiefly inhabited by species of the *didyma* group, which alone appear able to become adapted to the ecological conditions. The forms which occur are intimately related to those which have developed in the highlands. In addition to the more typical species, the desert region provides at least five anomalous forms. These consist of *trivia* W.V. and *arduinna* Esp., each of which occurs over a wide area from Turkestan to Europe. The former indeed is found from Baluchistan to Spain. Other

atypical forms include *M. collina* Led. with a restricted habitat in Syria and Asia Minor, *M. turcmanica* Higgins known only from Askhabad in Transcaspia, and *consulis* recently described by Wiltshire from Shiraz. These three closely related insects form a natural group closely allied to *phoebe* W.V. It is very probable that another species, *casta* Kollar, occurs in southern Persia, but at present I have not seen a specimen, and from the same country came *wiltshirei* described on p. 237. Finally *M. abyssinica scotti* Higgins has lately been found to represent the African form in southern Arabia, and it would not be surprising if this species also were found to inhabit Persia. The following species are characteristic of the central Asiatic desert fauna :—

1. *Melitaea trivia* W.V.
2. *Melitaea persea* Kollar.
3. *Melitaea deserticola macromaculata* Belt.
4. *Melitaea abyssinica scotti* Higgins.
5. *Melitaea didymina* Stgr.
6. *Melitaea acreina* Stgr.
7. *Melitaea athene* Stgr.
8. *Melitaea arduinna* Esper.
9. *Melitaea collina* Leder.
10. *Melitaea turcmanica* Higgins.
11. *Melitaea consulis* Wiltshire.
12. *Melitaea wiltshirei* Higgins.
13. ? *Melitaea casta* Kollar (see note below).

There are two further species to record, which inhabit the mountains in the north-west of the region. In the Elburz and Demavend ranges in northern Persia is found *saxatilis* Christoph, at present extremely rare. The wing-pattern and genital structure suggest a close relationship to *didyma*, and *persea*. I have also seen from Persia a specimen of an insect very near to *ambrisia*, so an extension of the *fergana* group to the west is quite possible. If this should prove to be the case, it would provide evidence of close association between the Pamirs and the Elburz. The second species referred to is *M. transcaucasica* Turati, which is known only from the Transcaucasus at the north-west limit of the region. The two following western mountain species are therefore included in the central Asiatic fauna :—*Melitaea transcaucasica* Turati; *Melitaea saxatilis* Christoph. In addition to the 30 characteristic species already mentioned, two European insects, *M. didyma* and *M. phoebe*, have a wide distribution in the region, while *M. cinxia* appears in the north and west.

The anomalous species referred to above merit more than casual notice. In various ways, but particularly in the structure of the genitalia, they show unusual and divergent characters. In the case of the species *agar* and *arduinna*, the male genitalia show many features of the *cinxia* group, but the structure of the female recalls *didyma*. Somewhat less striking, but nevertheless isolated and unrelated characters, are shown by quite a large number of species, including *trivia*, *yuenty*, *athene*, *lutko*, *romanovi* and *shandura*. Such anomalous forms are not known in the genera *Euphydryas* and *Mellicta* : they occur only in *Melitaea*. Most of these butterflies show very restricted distribution areas, which often occur at the extreme limit of a faunistic zone, as, for example, in *lutko*, *romanovi*, *agar* and *yuenty*. They all appear in the central Asiatic and Tibetan distribution zones, but they do not occur in northern Asia or in Europe, with the exception of the single species *trivia* W.V. I think there can be no doubt that these are relict forms which have arisen in central Asia, and have been forced to the very limit of their faunistic zones by the appearance and extension of later evolutionary forms. Presumably their further withdrawal has been obstructed in the north and west by the presence of the vigorous Euro-Siberian fauna. It is remarkable that *yuenty* and *agar*, two

representatives of this group, should have migrated far from their origina home, and now occur only in the east in the Chinese provinces of Szechuan and Yunnan.

Note regarding Melitaea casta *Koll.*

I have letters from Mr. Wiltshire recording the discovery of an insect near Shiraz in southern Persia, which is almost certainly referable to this species. Unfortunately it is not possible just now to obtain a specimen for description and illustration, but it is desirable to make a record of the observation.

Classification.

Until quite recently it has been the custom of most authors to include all species in the single genus *Melitaea*. In 1872 Scudder erected *Euphydryas* for *phaeton* Drury and its allies, which include the Palearctic *aurinia* Rott. and *maturna* Linn. The name will be adopted in this paper, and I am glad to see that it is coming into general use, as the features of this group are very distinct. The number of species in the more typical Melitaeine group is very large. More than 100 years ago they were divided by Hübner into *Schoenis* and *Cinclidia* ([1819], *Verz. bekannt. Schmett.*: 28–29) but for some reason these names have never been accepted. It happens that later citations of typical species have made both these names redundant. It seems to me, however, that a large genus is not only very inconvenient but undesirable where, as in this case, there are two well-marked groups which have a zoo-geographical significance. The necessity for some division is even more obvious if the numerous allied American forms are taken into account. These are divided rather empirically into *Phyciodes*, *Eresia*, *Chlosyne* etc. but the European divisions are at least as well marked. To be consistent, the more typical species must be dealt with together in one enormous genus of about 200 species, or else both the Palearctic and American species must be divided into natural sections. The Palearctic species, about 63 in number, fall naturally into four groups. Of these *athalia* and its allies form an obvious and well-defined section for which the name *Mellicta* Billberg is available. The remaining groups containing *didyma*, *cinxia* and *phoebe* are less well defined and a generic distinction is not always possible. These species are included therefore in the single genus *Melitaea*, but the specific groups are considered separately. In the following table I have indicated the most important generic and group characters.

The saccus in the male genitalia not developed . . . . . *Euphydryas*.
The saccus in the male genitalia developed.
In female genitalia the bacillus double . . . . . *Mellicta*.
In female genitalia the bacillus single or forked. . . . . *Melitaea*.

The specific groups in *Melitaea* may be compared as follows :—

Imago. Wing-pattern.

	didyma group	*cinxia* group	*phoebe* group	*Mellicta*
Upperside	usually macular	usually linear	large submarginal crescent on fore-wing	linear
Underside	h.w. no orange in cell 1b.	h.w. usually orange in cell 1b.	h.w. orange in cell 1b.	h.w. orange in cell 1b.
Submarginal spots	absent on hind-wing	often present on hind-wing	often present on hind-wing	absent on hind-wing
Basal spots	black	usually black	black	orange

Male genitalia.

	didyma group	*cinxia* group	*phoebe* group	*Mellicta*
Tegumen	narrow and conical	wide	wide	wide
Ringwall	long	short	short	short
Penis-groove	often deep	shallow or flat	shallow or flat	flat
Clasp	Oval and long	oval	oval and short	quadrilateral
Harpe	horizontal and toothed	vertical and simple	vertical, simple and heavy	vertical and toothed
Posterior process	slender and tapering	from superior angle	very wide	from inferior angle
Penis morula	absent	present	present	present
Ostium-keel	rudimentary gaping	rudimentary apex present	rudimentary	present

Female genitalia.

Bacillus	single	forked	forked	double
Bursa copulatrix	oval	oval	oval	oval
Scutum	very small	moderate	larger	large
Auricles	small	large	very large	very small

Male fore leg.

	large, tarsus varies	tarsus atrophic	large, tarsus 4-jointed	small, very atrophied

Labial palpi.

	short and very hairy	longer	longer	long, especially the last joint

Nomenclature.

By means of morphological characters, aided sometimes by biological observations, it has been possible in most cases to define specific units with confidence. The classification of infra-specific variation is less satisfactory, and unfortunately it is not yet possible to apply known genetic principles as a basis for nomenclature. Most *Melitaea* species show a number of variable characters, and in many cases the variation shows every stage between two extremes, producing characteristic character gradients, for which Huxley has introduced the term *cline*. Very often the same cline appears in many different species, producing striking parallel variation. The conception of graduated series cannot yet be expressed by any recognised nomenclature. It is far from easy to evolve a taxonomic method for the description of these series, nor could any method be applied until the genetic structure of the species is better understood than is the case at present. It is clearly fundamentally wrong to attempt to split such a series into a number of clearly defined nomenclatorial units, so I have endeavoured to incorporate the names of the extreme forms produced in this way, but transitional forms are only recorded occasionally. Variation of this kind certainly depends largely upon ecological factors, and would come into the category of *formae tempestatis*, but in widely distributed species such as *didyma* and *phoebe*, individuals living in widely separated localities are rarely quite the same, although the ecological characters may appear equally developed. Often such specimens will differ in small details, difficult to analyse, which may lead to a slight change in the facies of the insect. There can be little doubt that the genetics of a widely distributed species are very complicated. In the first place, and most obvious, are marked seasonal changes, the genetic mechanism of which is not clear,

which may reappear in a majority of related species. Secondly there are small differences, no doubt due to local preponderance of unusual genes, which often appear sufficiently commonly to alter the facies of the population in a given locality, but nearly always absent in a few individuals which fail to show the local characters. Variation of this kind, in which both seasonal and local variation appear closely related, is of great interest as a problem of genetic mechanism, but in the absence of exact knowledge it is scarcely possible to express it in taxonomic terminology, and any attempt to do so would certainly lead to confusion and error. It is very possible that such variation shows those slight disturbances of the general genetic equilibrium, which must arise in an actively mutant species with an extensive distribution, and it appears to me that there is no real indication of a significant divergence from the normal specific constitution. Such forms I have simply called modifications (mod.), a term which implies no explanation of the mechanism of variation. It is not possible to define accurately taxonomic terms, but I think that in my personal interpretation of *modification* there is an underlying thought of an unstable and easily reversible variation, which seems chiefly the result of the action of those unknown local modifying factors which certainly exist. I have reserved the category of subspecies for those much rarer cases in which a fresh character appears which cannot be explained as a seasonal change, and which shows a definite geographical distribution. Without attempting to give a definition of a subspecies, I think the underlying idea here involves a conception of slight but irreversible variation, not dependent upon ecological conditions, which presumably has a biological value and enables the variant to remain established over a certain region. At the same time, the typical subspecies and the variant cannot retain individuality when they come into close relationship, so that in cases where the distribution of both forms is continuous, it is not uncommon to find transitional forms where the distribution areas fuse, as in *M. didyma* and *M. diamina*. In other cases, as in the *arcesia* series, the distribution areas of different units may be isolated. In such cases it must remain a matter of individual judgment whether closely related forms should be united or be given full specific rank. Whenever possible, I think such forms should be associated as subspecies, as giving a better indication of very close relationship.

Genus 1. **MELITAEA.** Distribution Map 1.

Melitaea Fabricius, 1807, *in* Illiger, *Mag. Insektenk.* **6** : 284. Type *Pap. cinxia* Linn.
Melitaea Dalman, 1816, *K. Vet. Acad. Handl.* **1816** : 57.
Melitaea Westwood, 1840, *Introd. mod. Class. Insect.* **2** (Syn.) : 88.
Schoenis Hübner, 1818, *Verz. bekannt. Schmett.* : 28. Type *Pap. cinxia* Linn.
Schoenis Scudder, 1875, *Proc. Amer. Acad. Sci.* **10** : 268.
Cinclidia Hübner, 1818, *Verz. bekannt. Schmett.* : 29. Type *Pap. phoebe* W.V.
Cinclidia Scudder, 1875, *Bull. Buffalo Soc. nat. Sci.* **2** : 142.

Markings on the upper surface linear or macular. On the under surface the spots at the base of the hind-wing are nearly always black. In the male genitalia the clasps are oval or truncated posteriorly. The tegumen conical or wide and shallow. The ringwall usually shows a penis-groove. The penis is gaping or with an upturned apex, not showing a large ostium-keel. In the female the bacillus is single or forked, and the scutum nearly absent or of moderate size. The bursa copulatrix is oval. The palpi are definitely ascending (fig. 8a).

This genus, composed of about 40 species, is heterogeneous, and shows two or possibly three natural groups each with definite and constant characters

of generic type. On casual inspection a separation into two genera seems immediately justified, with *didyma* and *cinxia* respectively as the typical species. This separation holds good for all but three anomalous and archaic species, namely *arduinna* Esp.; *agar* Ob. and *lutko* Evans. In these insects the general scheme of markings suggests close relationship with *cinxia*, with which indeed some characters of the male genitalia agree, but the female genitalia show unmistakable affinity to *didyma*. The separation into two groups is therefore incomplete, and the third group, of which *phoebe* is typical, is too near to *cinxia* to be dealt with separately, unless *didyma* can also be separated. The series is most interesting owing to the persistence of these archaic forms, although the dominant groups are now so far isolated that it is really difficult to specify generic characters common to all. Consequently the genus must be defined in the widest terms, and even this is not easy. The group characters are much better defined, but of course these distinctions break down in the insects named above which show relationship to both the principal sections. Therefore it is necessary either to divide *Melitaea* into two genera connected by transitional forms, or to adopt the unsatisfactory alternative of dealing with the species groups without giving these groups a name. I have chosen the latter course as being more in accord with present-day custom. At the same time, there is no doubt that all the species in *Melitaea* are closely allied, and except for some unimportant details all three groups show the same zoo-geographical relations, of which the most outstanding feature is the remarkable concentration of species in the central Asiatic region. (30 species Map 1.)

In order to avoid confusion I have accepted Westwood's specification of *cinxia* as the typical species. My personal view is that the specification of *athalia* Rott. would be more correct. There is no doubt that the Fabrician *maturna* was the same species as *athalia* Rott. Fabricius never identified correctly the Linnaean *maturna*, nor did Hübner, who followed him so closely. I feel therefore that Dalman was correct in citing *athalia* as the type of *Melitaea*, since Fabricius had done his best to include this species in his genus, but of course he only knew it as *maturna*. For some reason von Rottemburg's names were never accepted by Fabricius, Hübner and many other authors of that time.

a. ***didyma*** group.

1. *Melitaea didyma* Esper.
2. *Melitaea transcaucasica* Trti.
3. *Melitaea persea* Kollar.
4. *Melitaea montium* Belter.
5. *Melitaea saxatilis* Christoph.
6. *Melitaea deserticola* Oberth.
7. *Melitaea abyssinica* Oberth.
8. *Melitaea wiltshirei* Higgins.
9. *Melitaea didymina* Stgr.
10. *Melitaea didymoides* Eversm.
11. *Melitaea acreina* Stgr.
12. *Melitaea ala* Stgr.
13. *Melitaea chitralensis* Moore.
14. *Melitaea pseudoala* Sheljuzhko.
15. *Melitaea sutschana* Stgr.
16. *Melitaea fergana* Stgr.
17. *Melitaea lunulata* Stgr.
18. *Melitaea ambrisia* Higgins.
19. *Melitaea infernalis* Groum-Grshmailo.
20. *Melitaea shandura* Evans.
21. *Melitaea athene* Stgr.
22. *Melitaea trivia* W.V.
23. *Melitaea yuenty* Oberth.
24. *Melitaea arduinna* Esp.
25. *Melitaea lutko* Evans.
26. *Melitaea romanovi* Groum-Grshmailo.
27. *Melitaea agar* Oberth.

Group characters. The butterflies of this section, of which 27 species are now described, form a very homogeneous group which can usually be identified at a glance. In the perfect insect the black markings on the upper surface are often irregular and broken into a series of spots. On the under surface of the hind-wings the black markings are also rarely linear. The thin double marginal line, so obvious in *athalia* and its allies, is altogether wanting. In many species the tone of the orange ground-colour and the extent of the black markings are very variable (see *M. didyma*, p. 200). The female is usually larger than the male with a strong tendency to greyish suffusion on the upper surface. The fore legs of the male are relatively long, the tarsus not infrequently with four distinct joints. In *didyma* and some other species the tarsal development is not constant. The palpi are ascending and densely clothed with orange hairs. The second joint is long and rather stout, the terminal joint ovoid or peg-shaped. Viewed from above little more than the terminal joint is visible. The life-history is known only in the case of *didyma* and *trivia*, but I can find no adequate account of the sculpture of the egg. In both these species the larvae show a collar of bristles along the anterior margin of the first thoracic segment with six definite blunt spines. The insects produce two or possibly more annual broods at low altitudes.

The male genitalia are large and long. The narrow cone-shaped tegumen is very characteristic, and immediately below it are wide lateral flaps folded and approximated on each side to form a channel for the passage of the anal gut. This channel which Suschkin terms the anal cone ("analkegel") is completed below by some firm fibrous ligaments which can usually be seen in a fresh preparation. The lateral flaps and their posterior processes, combined as the scaphium, are very obvious in some species (*M. lunulata*, fig. 90). The ringwall is long and grooved distally to hold the penis. The penis-groove is often deep and more or less closed above by the lingulae, between which strong ligaments pass to complete the channel, and from the orifice thus formed the penis is suspended by a ligamentous diaphragm, sufficiently loose to allow an excursion of about 1 mm. in protrusion and retraction. The condyle appears as an anterior extension of the lingula but usually it is not obvious. The claspers are oval, strongly convex laterally. They are hollow structures with a long slender posterior process curved from below upwards and from without inwards. Above this the tuberculated area usually shows a well-marked spine. The harpe is relatively small. It appears to be attached at its base to the ringwall in the neighbourhood of the condyle. The proximal part runs backwards, applied to the internal aspect of the clasp, but at its termination it leaves the clasp and is directed horizontally inwards as a sickle-shaped process which is often armed below with one or more teeth. In the typical species the penis is very distinctive. It is thick and strong, sometimes strongly curved. In many species no ostium-keel is visible; in a few it is distinctly present but it is never large. The penis terminates abruptly at the level of the ostium-folds and the distal extremity appears to be widely open and gaping. The structure in *M. fergana* and its allies diverges slightly from this description. In these butterflies the penis is curiously flattened from above downwards and the harpe is often large (*M. ambrisia*, fig. 104). The other characters of these butterflies show that they are correctly placed with *didyma*.

The female genitalia in this group are most distinctive. They show a low cone on each side of which appear the small auricles. As a rule no scutum can be seen. The bacilli are fused into a single rod, sometimes slightly forked at the tip. The bursa is oval.

Distribution. The distribution of each insect is dealt with in detail later, but at the expense of some repetition it is interesting to examine that of the group as a whole. The last six members, all atypical, have been already considered (p. 191). The remainder, nineteen more or less typical species, are distributed throughout the warm and temperate part of the entire Palearctic region, with the exception of the Himalaya and Tibet. In Europe and in western Asia, the *didyma* group attains to about the 50 deg. of north latitude. In eastern Siberia it extends farther north, but only one species (*latonigena polaris* Gr.-Gr.) is known to approach the Arctic circle. True alpine forms occur, particularly in the Pamirs and Karakorum, where several species fly up to 12,000 ft. or even more, but such elevations are exceptional. On the other hand, desert forms are common and include *deserticola* Ob., *dodgsoni* Gr. Smith, and *acreina* Stgr. in addition to *didyma* Esp., which seems able to exist under the most varied climatic conditions.

In Europe and northern Asia west of Lake Baical only one typical species —*didyma* Esp.—is known to occur. This insect is also found in Africa so far south as the border of the Sahara, where it is replaced by *deserticola* Ob. The latter penetrates the desert for at least 400 miles and has been taken also in Egypt, while *abyssinica* Ob. has been recorded from Abyssinia and in a slightly different form from two localities in the Arabian highlands. In Asia Minor *didyma* is very generally distributed, and in addition the characteristic Asiatic *persea* Koll. appears as far west as the Taurus Mountains in the form of *arraratica* Vrty. Both these insects are also met with in the Lebanon, which is the northern and eastern limit of the range of *deserticola*. The little *montium* Belter has a curiously restricted habitat in the same mountains. In the southern Caucasus and Transcaucasus *transcaucasica* Turati flies in high subalpine and alpine surroundings, while at lower elevations forms of *didyma* and *persea* occur, both of which seem to be very generally distributed in the foothills to the south and in Transcaspia in the east. Very little material from Persia is available. In the north the rare *saxatilis* Christoph is found on Mt. Shahkuh and on the Demavend. In both cases the distribution appears to be very restricted. Another recently discovered species, *wiltshirei*, is known from two specimens from the Alvand, also in northern Persia. At lower elevations in the north and west *didyma* occurs, but the most characteristic insect is again *persea* in the somewhat modified form *hafiz* Higgins. This species also flies with *didyma* in Syria and extends through Transjordan and Mesopotamia to Baluchistan. In Ferghana and the western Thian-Shan *didyma* attains the eastern limit of its range and occurs as the rather specialised *turkestanica* Shelj. In this district also, on the plains around Kokand, is found *acreina* Stgr., a species which does not appear to occur elsewhere. In Ferghana the western species meet the numerous forms which occur in the great mountains of Bokhara. This relatively small district, comprising the Pamirs, the Alai and associated ranges, appears to be the chief centre of the group today. No fewer than seven distinct and indigenous species occur, and *didyma* is not represented in its typical form but by a subspecies which is possibly distinct. In the Pamirs and Karakorum are found *chitralensis* Moore, *didyma mixta* Evans, *fergana* Stgr. and *shandura* Evans. In addition *ambrisia* Higgins flies in the western Alai, probably also in Persia, and farther north *pseudoala* Sheljuzhko and *lunulata* Stgr. occur in the Alexander mountains, where also *ala* Stgr. extends from the Thian-Shan. An outlying member of the fauna is *infernalis* Gr.-Gr. which is found farther east in the Boro-Choro mountains. These butterflies include five members of the *fergana* group which is confined

to and is characteristic of these mountains. With the exception of *M. ala*, which penetrates along the Thian-Shan to the Amdo, it is rather surprising to find that these insects do not extend to the east, and they are absent from Mongolia, the Himalaya and Tibet where conditions of life appear so suitable.

North of the Thian-Shan the very specialised Pamir fauna abruptly disappears and the western *didyma* is found once more in Dzungaria, a comparatively flat district by which the species enters eastern Asia and extends to the Amdo, probably crossing Mongolia. At least one other species, *M. athene* Stgr., exists with *didyma* in Dzungaria, and perhaps *M. didymina* Stgr. may occur along the northern slopes of the Thian-Shan.

An entirely different fauna appears to the north of Dzungaria. In the Changai Mountains this is characterised by the absence of typical *didyma* which is represented by the subspecies *latonigena* Eversm., accompanied by *didymoides* Stgr. and *didymina* Stgr. In the Sajan and Altai Mountains *latonigena* also occurs. In the latter locality the form appears to be imperfectly differentiated and in some places at least there is also found typical *didyma*, which here reaches the extreme north-eastern limit of its range. As far as I am aware, *didymoides* has not yet been found in the Altai, but farther east in the Kentei it occurs once more with *latonigena*, while in the north *sutschana* Stgr. begins to appear along the Amur river, whence it extends eastwards into Ussuri and Corea. North of this district on the Vilui and in Verchojansk forms of *latonigena* appear once more and approach the Arctic circle as *polaris* Gr. Its area of distribution will probably be found to be continuous east of Lake Baical with the more typical *latonigena* of the Sajan and Kentei Mountains. Finally in Manchuria and northern China *didymoides* has an extensive range in a large lowland form. Its distribution probably extends unbroken to the Kentei Mountains in the west. In the north it penetrates to Corea, where it comes into relation with *sutschana*, while it extends southwards in a slightly modified form *latonia* Gr.-Gr. into the highlands of Kansu and Amdo.

1. ***MELITAEA DIDYMA*** Esp. Plates 1 and 2. Distribution Map 2.

Pap. didyma Esper, 1779, *Die Schmetterlinge* **1** : 365. Loc. Uffenheim in Bavaria.
Pap. cytheris Mueschen, *in* Gronovius, 1781, *Zoophylacium* **3** (Index). Loc. Austria.
?*Pap. athulia* [sic] Fabricius, 1787, *Mantissa Insectorum* **2** : 59. Loc. North Russia.

Fore-wing ♂ 17–23 mm., ♀ 19–25 mm.

The great variability of this insect makes any attempt at description exceedingly difficult. In the typical form the general scheme of markings is well known, and I propose only to indicate some features which are of importance in separating *didyma* from allied species.

On the upper surface in the male the submarginal series is composed of distinctly separated spots, of which that in cellule three of the fore-wings is usually conspicuously large. On the hind-wings the spots or thick crescents of the submarginal row are also separate, and rarely, if ever, join to form a continuous series. On the under surface the submarginal spot in cellule three of the fore-wing is even more prominent. On the hind-wing the proximal orange fascia is continuous, not broken into a series of independent macules. The submarginal orange fascia is bordered internally by the post-discal and externally by the submarginal black spots. The formation of this fascia, therefore, is not confused by any other (secondary) black lunules. The exact position of the black spots of the discal row and of those on the costa and in cellule 1, are too variable to be of any value, and moreover they retain the same formation in the majority of related species. In the female the markings on the upper surface are usually

more complete and often partly obscured by greenish or grey suffusion. On the under surface the female resembles the male.

The genitalia in the male are large and wide (fig. 1). The penis-groove is not closed by the lingulae. The clasp (figs. 2, 3, 4) is long and cylindrical, the borders roughly parallel. The posterior superior angle is usually provided with a sharp spine and several smaller projections of unequal development. The posterior process is strongly curved from without inwards. The harpe is armed below with one or more well-developed teeth. The penis (fig. 5) is strong and evenly curved, the distal extremity open and gaping. The ostium folds are conspicuous. In many specimens from eastern Russia the spine of the

FIGS. 1–8.—*Melitaea didyma didyma* Esper. 1. Male genitalia, dorsal view. Charroux, N. France; 2. Clasp, lateral view. Oulz, Piedmont; 3. Clasp, lateral view. Naryn, Turkestan; 4. Clasp, lateral view. Lambessa, Algeria; 5. Penis, lateral view. Charroux; 6. Female genitalia, dorsal view. Algiers; 7. Male fore leg. Switzerland; 8. Male fore leg. Naryn; 8a. Palp.

clasp is exaggerated and the posterior process is more sharply bent, so that it overlaps its fellow in adduction.

This peculiarity of the genitalia of oriental *didyma* was first noticed by Suschkin in *neera* (1913, *Z. wiss. InsektenB.* **9** : 169). According to Hormuzaki, it is also characteristic of his *didyma crasnensis* (1934, *Bul. Fac. Stiinte Cernow.* **8** : 22). Similar specimens also occur in Bulgaria, but I have not been able to correlate any external characters with this peculiarity. It is probable that a systematic study would disclose other local variations in the shape of the male genitalia.

In the male the fore tarsus is comparatively short (fig. 7), composed as a

rule of one or two joints. In oriental specimens and in those from northern Africa three distinct joints are usually present (fig. 8) and even four may be met with. The female genitalia (fig. 6) show a strong bacillus arising from a low cone. The auricles are small but distinct, and the scutum scarcely developed.

The yellowish-grey larva is well known and has been illustrated by many authors. According to Frionnet it lives on *Plantago*, *Veronica* and other low plants. The collar of spines behind the head is unusual and I can only find this feature illustrated by Roesel (1761, *Insect. Belust.* **4** : pl. 13, 2), who gave an excellent figure of the larva and pupa. In cool districts and at high altitudes a single brood appears in June or early July. In warmer parts of the south of Europe two broods are usual and in hot localities three broods have been reported.

Distribution. In more or less typical form *M. didyma* has a most extensive distribution. In the west, in southern Europe, it is one of the commonest and most widely distributed of butterflies. It extends northwards nearly to the 50th deg. of north latitude, and appears also in Africa north of the Sahara. Towards the east the species spreads farther northwards to attain perhaps the 60th deg. in European Russia. In this direction the limits of its range are difficult to fix. In western and central Asia *didyma* is very generally distributed, extending southwards approximately to the 35th deg. Its range therefore covers the entire south-western Palearctic region. The insect appears to be absent from Arabia and I am unable to say whether it occurs in the south of Persia although it is certainly common in the north of that country. In the south-east *didyma* disappears in the Hindu Kush and Pamirs, where it is replaced by a well-marked subspecies, which extends to the southern slopes of the mountains of Chitral. It does not cross the Thian-Shan, but north of these mountains the typical form is found in the western Altai and Semipalatinsk, and it also occurs in Dzungaria and appears to spread thence across a narrow strip of country through Mongolia at least as far as the Amdo district. There is thus an intrusion of a western Palearctic form between the Tibetan and East Siberian regions and in some parts at least of this district it is accompanied by *M. phoebe*. I have no material to show the probable northward extension in the province of Tomsk. Somewhere in the central Altai the character of the insect changes and it is replaced by the well-marked subspecies *latonigena* Eversmann, which has a wide range in eastern Siberia.

Localities :—Europe. The whole southern and central districts. In France it flies as far north as Ille-et-Vilaine, in Germany to the Harz Mountains, Mecklenberg and Prussia. It is recorded also from Lithuania and is local and scarce in its northern localities. Africa.—Local in Algeria and Morocco, extending to the High Atlas Mountains. Asia.—Asia Minor, Armenia, Syria, Mesopotamia (rare), north Persia, Transcaspia and western Siberia, Turkestan and Dzungaria to Semipalatinsk and the western Altai Mountains, Amdo.

Variation. *M. didyma* is one of the most variable of Palearctic butterflies. Its distribution is very great, although each colony appears to be strictly localised and no migratory movement is known to take place. It occurs in Europe from sea-level to an altitude of 6000 ft. and it is equally at home upon the scorching plains of central Asia. Indeed in its apparent disregard for climatic conditions, *didyma* stands alone among the Melitaeids. At the same time, the insect appears to be very sensitive to physical conditions, and in

my opinion the variability is largely due to this fact. It seems that only in this way can one explain the marked differences in facies which may occur within the range of a few miles. The result of these factors is a most confusing range of forms of somewhat doubtful status. Nearly a hundred varieties and subspecies have been described and named, many of which I find it quite impossible to distinguish without reference to the locality labels. Moreover, the described differences frequently disappear when long series are compared, as is essential in the study of such an insect as *didyma*, in which local variation is so marked. There is, moreover, some reason for supposing that the same locality does not always produce the same form in different years, possibly on account of changing climatic conditions. Except in the most northern part of its range, the position is further complicated by the occurrence of two or perhaps three broods, often quite dissimilar. In my opinion it is not possible to say at present what alterations in marking, if any, are of value in studying the geographical variation of this species. The series of forms is nearly infinite and I believe that the attempt to describe each one results in confusion. I propose therefore to indicate only the main lines of variation, each of which constitutes a cline.

The ground-colour of the upper surface of the wings may be considered first. It varies from an intense orange-red to a pale orange-yellow. The colour is paler in examples from hot and dry localities and in second-brood specimens. This fact is very obvious. It was pointed out by Staudinger in 1879 (*Hor. Soc. ent. ross.* **14** : 268). Again Verity (1924, *Ent. Rec.* **36** (Suppl.) : 37) elaborated the seasonal changes. His central Italian form emerges first as *protea* Vrty (dark) followed by *romana* Calb. (paler) and the second generation commences as *caldaria* Vrty (palest) and finishes as *romula* Vrty. The females associated with the pale second brood are never suffused. Males from north-west France are frequently pale and in this respect resemble Spanish and African examples rather than those of central Europe. It is interesting to note this similarity in races inhabiting localities with such different climates but included in the well-known Lusitanian faunistic area. I should assume this character had a geographical significance, but very similar specimens occasionally occur elsewhere. The absence of red in most specimens from southern Spain and Africa is very marked, although the species occurs here quite high up in the mountains, and this is also true of specimens from the lower elevations in western and west-central Asia. On the other hand, mountainous districts usually produce males of a darker reddish-orange associated with suffused females. Such specimens in which the colour is very intense occur in the Pyrenees, the Alps and over most of the European range. Farther south, in many parts of Italy and along the Mediterranean coast, the fiery colour appears only in the first brood. Later broods are paler and approach examples from western Asia. In Asia, except at the lower elevations, the same reddish tone prevails. In Asia Minor, where very pale forms occur in many places, the mountain forms are quite unusually dark. I have such specimens from near Brussa and other localities, and they are recorded from the same district by Belter, always associated with a large proportion of suffused females. I think it cannot be doubted that the paler forms of *didyma* are associated with a low altitude and a hot or dry climate, the darker forms with cooler and moister surroundings such as are especially likely to occur in mountainous districts. This generalisation is not confined to *didyma*. Throughout the genus it appears to be true that the desert species are pale and yellowish, while the mountain forms are fiery orange-red.

Female specimens may be coloured as the male, but in Europe they are usually more or less suffused with greenish-grey (*i.e.* black scales on yellow ground). This suffusion is most marked in mountainous districts. It occurs in extreme degree in the Pyrenees, the Alps, some parts of the Balkans, in Podolia and in some parts of Asia Minor, but it is never uniform throughout a series. Its presence or absence does not appear to be associated with any other change in the local form met with in the district. For example, in the Taurus the dark females fly with males of the form usually found in Asia Minor. At lower altitudes, both north and south of the Alps, the greenish suffusion becomes less marked. In very hot localities, such as the south of Italy, it may disappear entirely. It is not found in Iberia nor in North Africa, although the species may occur there at a considerable elevation. Where a second brood is produced the females are always less suffused than those of the first brood. It is curious to note that the suffusion is almost or quite absent in central Asia. The female *didyma* of the great ranges of the Thian-Shan and the Alai are large and the markings are often heavy and complete, but I have never seen any tendency to dark suffusion. I can only suppose that the climate in these mountains at the levels frequented by *didyma* (up to 6000 ft.) is relatively hot and dry. Nevertheless I think it is fair to suppose that the development of dark females is probably a response to altitude, moisture, cool temperature or some related factor.

Variation in the markings of the upper surface is chiefly obvious in the presence or absence of the post-median row of spots on the fore-wings and of the discal spots of the hind-wings. Although these are never really constant in their development, they seem to possess some significance, especially those of the hind-wings. In the typical form of the German plains these spots are usually well developed on all the wings. Such specimens preponderate in Europe in the north, west and south-west districts, in Hungary, Czecho-Slovakia, Germany, north and north-western France, Spain and North Africa. The development of these spots does not appear to be related to the colour of the females, which are often rather suffused in the more eastern districts, nor to that of the males which are quite dark in Hungary and Czecho-Slovakia and become progressively lighter through Germany and France until in Africa they are as a rule quite pale. Throughout the greater part of Europe the development of these spots is erratic but on the whole they are certainly more constantly present in the extreme north and west. They are, however, well marked in a series in my collection from the Engadin taken at 6000 ft., the highest limit of altitude for the species in Europe. In Asia and in Russia east of Sarepta there is a sudden and surprising change. The spots disappear, leaving a wide post-median fascia of clear orange while the field of the hind-wings is unmarked. Of course many exceptions occur and examples without post-median spots are often met with in the eastern Mediterranean. Considering the great variability of the species, however, it is astonishing how constantly these spots are suppressed in Asiatic specimens. Moreover, the exceptions occur locally. In my own collection they are common from the Hissar Mountains and in various localities in Transcaspia, but most uncommon in anterior Asia, the great ranges of the Thian-Shan and Alai, and the plains of southern Russia as far east as Semipalatinsk.

The development and number of the black markings is also influenced by environmental changes, but the relation is not clear. Second-brood specimens are not only small and pale, but the markings are usually scanty and reduced in size. This is certainly true of the great majority of European and Asiatic

specimens, but in North Africa, where the conditions appear to be similar, the markings are often unusually large and complete.

Another character appears in many examples from the mountains of central Asia in the shape of a small yellow mark on the upper surface on the costa of the fore-wings in front of the submarginal spots. I have rarely seen this yellow mark well developed in European specimens but it occurs occasionally as far north as south-east Russia. It is irregular in its appearance, and is certainly most frequent in specimens from the Thian-Shan.

These variations in marking of the upper surface are frequently very striking when series from different localities are compared. In my opinion they are too indefinite and exceptions are too frequent to suggest that these characters can be used as a basis for the separation of geographical races.

Lastly, *didyma* varies a good deal in size. Second-brood specimens are so constantly smaller than those of the first brood that it is impossible to avoid the conclusion that small size is, in many cases, the result of rapid development or inadequate food-supply, such as might reasonably occur in hot and dry summer weather. Mountain specimens, usually single-brooded, are often large, except those occurring at great elevations. There may be extreme differences in size within narrow geographical limits. Thus in Italy a very large form, *patycosana* Turati, is found on the Calabrian marshes, while very small forms, *romana* Calb., occur in hot and dry districts quite near. In Asia Minor the species is usually small, but in the mountains of the interior large races occur. The largest specimens of all are found in the Thian-Shan at an elevation of about 6000 ft. A very large form also occurs in the western Caucasus, where the summer weather is notoriously wet and hot, and the food-supply is probably abundant.

I think this account is sufficient to suggest that the definition of geographical subspecies based upon the obvious criteria of size, colour and wing-marking is extremely difficult if not impossible. In fact I have not been able to discover a single character which shows conclusively a geographical distribution. In my view the protean forms of *didyma* must be due to different environmental conditions. If this is accepted, there is nothing astonishing in finding that scarcely two localities produce quite the same facies, nor in the fact that specimens from widely separated localities are often more similar than those taken only a few miles apart. It is, nevertheless, convenient to group the forms, and in a very general way this is possible. In suggesting below a list of such named varieties, I should like to reiterate that the climate appears to be the most important modifying factor, and most of the following probably come into the category of seasonal forms.

Melitaea didyma didyma Esper, *loc. cit.* Plate 1 fig. 1.

The original description is of Bavarian examples, and consequently this form is to be considered nominotypical (Verity, 1919, *Ent. Rec.* **31** : 179). The specimens are usually of moderate size, and the ground-colour is often rather pale, and lacking the fiery tone found in southern specimens. The post-median spots of the fore-wings and the discal spots of the hind-wings are developed. The females are variable, and often show surprisingly little dark suffusion.

This form, with some examples from high altitudes in the Alps, shows the most complete pattern and perfect development of all spots met with in

the series. In this respect it contrasts with southern specimens in which the pattern is not well developed, represented by the *dalmatina* modification, and the two may be taken to represent the extremes of a very obvious cline.

Typical *didyma* is met with in Germany, Austria, Czecho-Slovakia, and in parts of Hungary, but it becomes less definite towards the east. Examples from northern France and Brittany are similar, except that the ground-colour is sometimes even paler, approaching that of Spanish specimens (*armoricana* Oberthur, 1909, *Étud. Lépid. comp.* **3** : 241).

Melitaea didyma mod. ***meridionalis*** Stgr. Plate 1 fig. 2 ♂, 8 ♀.

M. didyma var. *meridionalis* Staudinger, 1870, *Hor. Soc. ent. ross.* **77** : 60. Loc. Greece (Parnassus).

This form may be characterised as follows. The males are of moderate or large size, fiery chestnut red. The post-median spots of the fore-wings and the discal spots of the hind-wings are variable, and often tend to disappear. The females are more or less heavily suffused with dark scales. The name was proposed by Staudinger for specimens from Mount Parnassus with heavily suffused females, and was contrasted by him with *occidentalis* in which the females are little suffused. With the former may be united the great majority of European specimens, including those of the Alps and of the eastern European highlands. Very marked examples of this form occur on the southern slopes of the Alps at quite a low elevation. In some places it is found on the plain, usually, if not always, in moist localities. In hot countries such as Asia Minor, the females of mountain forms may show marked suffusion of a special type (*cinerea*) but the characters differ from those of European races (see *variabilis* Belter). In specimens from the Pyrenees the male is often more heavily spotted with black, as in specimens from northern Europe. At great elevations the specimens are reduced in size; such may be referred to *alpina* Stgr., which is really a name for Herrich-Schaeffer's figure 267, and is correctly specified as the type of *alpina* by Verity (1929, *Ent. Rec.* **41** : 43). The original of the figure is stated to have come from Asia Minor, but it resembles most female specimens from the high Alps, and this is the locality given by Staudinger in the second edition of his catalogue. There is an obvious cline leading from the yellow *androtropia* females (see p. 214), of warm southern countries, to the heavily suffused dark *viridescens* (see p. 222) forms of mountains and cool, moist localities, of which *meridionalis* represents the highest development. It was suggested by the late Lord Rothschild that the name *meridionalis* should be restricted to a Sicilian race, presumably a mountain form with suffused females (1917, *Novit. Zool.* **24** : 100). At its first appearance in 1861 the name is *nomen nudum*, although there is a reference to Sicily and to Turkey. Staudinger's first description in 1871 is of Graecian specimens, and it is equally evident that his intention was to contrast the dark females of this form with the pale females of *occidentalis*. The most extreme development of *meridionalis* features is found in Greece at Salonika (fig. 10), Karpinisi and other low-lying localities. This extreme form has been named *graeca* by Staudinger in the same article but the name appears superfluous. Many examples from the European Alps are only slightly smaller, and these should be referred here. The first generation from some localities in the Caucasus cannot be distinguished from it, but *caucasica* Stgr. (*i.e.* H.-S. : 588–590) strictly represents a form of *persea* Koll. (see p. 227).

Melitaea didyma occidentalis Stgr. Plate 1 fig. 7 ♀.

M. didyma var. *occidentalis* Staudinger, 1861, *Cat.* (Ed. 1) : 8. No locality.

This form is distinguished from *meridionalis* Stgr. by the paler fulvous of the upper surface in both sexes, and especially by the absence of dark suffusion in the female. The name was proposed by Staudinger in the first edition of his catalogue, with references to the following figures of Herrich-Schaeffer and Hübner :—

Hb. 869,870. A large male of unknown provenance.

H.-S. 133. A large pale female from South Russia.

H.-S. 324–7. Another species (*persea paphlagonia* Fruhst.) with a pale female.

The figure H.-S. 133 was subsequently and quite properly removed in the second edition of the catalogue, 1871, to *didyma neera*, and H.-S. 324–7 to *dalmatina*. Hübner's figure 869-870 was specified as the type of *occidentalis* by Verity in 1929 (*Ent. Rec.* **41** : 130), who suggested at the same time that it probably represented a Spanish specimen. Staudinger himself defined the name more clearly in 1870 (*Hor. Soc. ent. ross.* **7** : 60) as the form of western Europe with pale females. This meaning was adopted by Seitz. It may be used to include forms of Spain, southern France and Italy, except where referable to *meridionalis*. It has been customary for many years to give the name *occidentalis* a subspecific significance, and some further differentiation is probably useful. Lord Rothschild suggested restricting this name to a form of northern Spain (1917, *Novit. Zool.* **24** : 100); Verity goes further, and would limit it to " the largest Spanish race " which has been found at Albarracin and Orihuela in Arragon (1929, *Ent. Rec.* **41** : 131). Although such extreme restriction is beyond the scope of this paper, the action of Rothschild and of Verity indicates that the name may be applied to Iberian forms, with which those of Africa are so closely allied that separation is scarcely possible. These do in fact show some individuality, and may possibly represent a poorly differentiated subspecies. The chief character is found in the large and often exaggerated discal spots on the fore- and hind-wings. On the fore-wing the postdiscal spots are usually absent. These characters persist in the second generation, and *dalmatina* forms rarely appear, a feature in direct contrast to the trend of development in Italy. The ground-colour is darker in the first generation and in mountain forms, but varies a good deal in different districts. The females are pale, except possibly in the extreme north, and show the forms *androtropia* Fruhst. and *ochracea* Fruhst. (see p. 219). The *occidentalis* characters are not everywhere well developed, and transitional forms are common, especially at the higher altitudes. The characters are well marked in a series from Catalonia and from Arragon but specimens from Andalusia are not striking. In my opinion Melcon's name *castilliana* is not needed, as it is synonymous with *occidentalis* in the restricted sense. The name in fact is invalid. The small second generation has received several names (*cataminuta* Vrty; *cataoccasus* Vrty; *cataprotea* Vrty), all of which indicate the development of varying degrees of summer-brood characters. I have not seen examples of Sagarra's *supercaldaria*, of which the description suggests a *dalmatina* form. Many African races are not to be distinguished from those of Spain. Oberthur's *mauretanica* was founded principally upon specimens of the second generation, and from very hot localities, so that the features are strongly marked. The name may be applied to such specimens which are common in Africa, and, in my opinion, Verity's *occasus* should fall

as a synonym, while it is scarcely possible to differentiate from this the form *protaeoccidentis* Vrty.

Rothschild's *interposita* refers to mountain specimens of the first generation, which cannot be separated from typical *occidentalis*.

Italian forms fail to show any differentiation into a geographical group. The variation is extreme, depending no doubt upon the marked climatic changes met with in the peninsula, and on this account providing admirable proof of the importance of ecological, as distinct from geographical, factors in the production of differing forms. The races met with show the entire cline of transition from the alpine *meridionalis* to the most marked Asiatic facies. The confusing array of names given to the different transitional forms will be omitted here. In the first emergence the females often show a fair number of *viridescens* forms, and in some exceptionally moist and luxuriant localities large and broad-winged examples are developed, often with very complete markings (*patycosana* Turati). Elsewhere there is a strong tendency towards a pale ground-colour and reduced black markings. Most of such specimens may be grouped as *protea* Vrty, and in the later generation the specimens are smaller and the characters exaggerated, with the females always pale. The extreme " dry " form of the hottest localities (*romula* Vrty) is not separable from ordinary *dalmatina* Stgr., while mountain forms resembling those of Asia Minor are met with in Sicily and the extreme south. I have seen no specimens of the form *leopardata* Vrty from the Isle of Elba.

Melitaea didyma mod. ***variabilis*** Belter.

M. didyma variabilis Belter, 1934, *Arb. Morph. Tax. Ent.* **1** : 108. Loc. Brussa.
M. didyma sicula Stauder, 1928, *Lep. Rundsch.* **2** : 107. Loc. Palermo. *nec M. athalia* var. *sicula* Turati 1915.
M. didyma var. *occidentalis* Stgr. *secut* Rothschild, 1917, *Novit. Zool.* **24** : 100.

This is a form of moderate or large size. In the male on the upper surface the ground-colour is fiery orange-red, with the black macules often large. On the fore-wing the post-discal series is usually absent, and the disc of the hind-wing is nearly free from markings. The females are somewhat variable, but often develop a curious grey suffusion (*cinerea*, see p. 209).

This form appears in south-east Europe and Asia Minor, and on the whole it is fairly well characterised. The characters develop most strongly at high altitudes. It was described from the Achyr-Dagh, and appears widely distributed in Syria and Asia Minor. In Greece and in parts of Bulgaria there appear male specimens which are indistinguishable, associated with females which are usually rather darkly suffused. A series from Palermo cannot be distinguished from Brussa specimens, and shows the *cinerea* colour form of the female. This series probably comes from a mountainous locality, and according to Ragusa the Sicilian *didyma* vary greatly in different localities. The *variabilis* modification grades into *neera* in the north-east, where the black spots become smaller and the marginal line very thin. Elsewhere at low levels specimens are paler, and the most marked *ochracea* females appear. In some localities second-brood specimens are very small and *dalmatina* modifications appear.

Melitaea didyma mod. ***dalmatina*** Stgr. Plate 1 fig. 4.

M. didyma var. *dalmatina* Staudinger, 1861, *Cat.* (Ed. 1) : 8. Loc. Ragusa.

This form shows the outstanding character of most Asiatic *didyma* in the absence of the post-median spots of the fore-wings, leaving a wide band

of ground-colour before the submarginal spots, and the disc of the hind-wing clear and unmarked. The name was introduced with no description but with a reference to Herrich-Schaeffer's figure 131, a male from Ragusa. Typical specimens are small, the markings also small and neat. The females show marked *androtropia* or *ochracea* features and are not suffused. The form occurs in some hot and low-lying localities in eastern Europe, chiefly as second-brood specimens, but it is most characteristic of Asia Minor. In western central Asia the specimens are often larger and run into forms similar to *mauretanica*. It is exceptional to find the spots developed as in average western European examples. In the high mountains of Asia Minor the tone of the ground-colour is much deeper and the size is increased. The females often develop extensive silver-grey suffusion. In such races the spots of the male remain few and small (*variabilis* Belter).

The *dalmatina* modification presents specimens of the smallest size and with the scantiest markings. It represents, therefore, the extreme of two separate clines, and it might be supposed that both clines are influenced by the same ecological factors. Reviewing a large series of specimens, it appears to me that the small size is probably associated with a short feeding period or scanty food-supply, and such examples appear at the northern, southern and vertical limits of distribution of the species. The scanty markings are usually produced by a hot climate, and particularly in specimens from western Asia. Large specimens with few markings occur, so the two clines cannot be influenced entirely by the same factors. At the same time, markings are locally so variable in all districts, that the *dalmatina* features can scarcely be looked upon as a geographical (subspecific) modification. Verity has suggested restricting this name to second-brood specimens from southern Europe (1919, *Ent. Rec.* **31** : 181). In my opinion this would be wrong. European specimens cannot be distinguished from those of Asia Minor, where this form is so generally distributed, and which is one locality mentioned by Staudinger in his *Catalogue* of 1871. Moreover, such a restriction would fail to call attention to the Oriental characters which are present. For my purpose I think it is more useful to extend the scope of *dalmatina* to include those small races of the Near East which show the typical reduction in size and in the black pattern on the upper surface of the male.

M. didyma dalmatina is often associated with *M. persea* Koll. in one of its forms. Although in *persea* the submarginal orange fascia on the under surface of the hind-wings is usually bordered internally by fine black lunules, this is not always the case in male specimens, particularly those of the second and third generations (see p. 226, *M. persea*). The resemblance is then extremely close. Indeed I should have been inclined to place Herrich-Schaeffer's figure of *dalmatina* as a form of *persea*, only this species has not yet been recorded from Europe.

Melitaea didyma mod. ***neera*** F. de W. Plate 1 fig. 3.

M. didyma var. *neera* Fischer de Waldheim, 1840, *Bull. Soc. Nat. Moscou* **1840** (1) : 81, fig. Locality :—Lower Volga.

Exp. alar. 40–45 mm.

This is a form of moderate, or large, size, the ground-colour in the male bright orange-red, the spots usually few and small. The post-median spots of the fore-wings are absent and the disc of the hind-wings is unmarked. The markings of the under surface of the hind-wings are typically vivid and clear, although the black spots are delicately drawn.

The females are usually large and pale, with a yellow wash along the costa and no tendency to dark suffusion.

Examples of *neera* occur on the steppes of southern Russia east of the Black Sea, and apparently predominate in many localities in western Siberia and Turkestan. It is a form of the plains which grades into *dalmatina* on the one hand, and into *turkestanica* Sheljuzhko in the mountains of south-western Asia on the other hand. It is scarcely possible to define the characters of *neera* with precision, but at the same time, the delicate markings and clear pinkish tone of the upper surface in a typical male are distinctive. The female is better characterised, and in fact this sex is described by Fischer. The figure of the male given in 1840 shows a rather dark and heavily marked specimen with pointed wings such as I have seen from Sarepta. It is quite unlike the form usually described as *neera*, and is perhaps an example of the first brood.

Melitaea didyma turkestanica Shelj. Plate 2 fig. 1 (lectotype).

M. didyma var. *turanica* Staudinger, 1886, *Stettin. ent. Ztg* **47** : 231. Loc. Marghilan, Osch and Usgent.

M. didyma turkestanica Sheljuzhko, 1929, *Mitt. Münch. ent. Ges.* **19** : 354 nom. n. pro *didyma turanica* Stgr. 1886 *nec M. turanica* Erschoff 1874.

Exp. alar. 42–46 mm.

This name is usually applied to examples from the higher levels in the Alai and Thian-Shan. In its most characteristic form the specimens are very large, the median spots of the fore-wings heavily marked, but the post-median series is absent except for one or two small costal spots, as in *dalmatina*, *neera* and asiatic specimens in general. As a rule, the disc of the hind-wings is unmarked. In the females the wings are ample and the markings are more complete, but there is no general suffusion with dark scales. In the *genitalia* of the male the posterior process of the clasp is noticeably long and more sharply curved than in western specimens.

This is one of the most distinct of all *didyma* forms, and when the characters are developed it is quite unmistakable. It appears to represent a luxuriant mountain form in a region where much smaller specimens often approaching *dalmatina* occur at low levels. It is particularly common and well developed in the Naryn district and in the western Thian-Shan, but there, and in other localities, quite undistinguished specimens may occur. It occupies the extreme south-eastern area of the distribution of *didyma*, which seems not to extend beyond the Alai mountains, except possibly as the very distinct *mixta* Evans, which is certainly entitled to subspecific rank. *M. didyma turkestanica* closely resembles also *M. ala* Stgr. and the two species certainly fly together in some localities although *ala* is probably more at home at greater elevations than 6000 ft., which appears to be the usual level of *turkestanica*. On the upper surface the wide black marginal border and the black area in the cell of the hind-wings in *ala* should prevent confusion.

The specimen figured, which I have chosen as lectotype, is from the Staudinger collection. Unfortunately the locality is not marked, but there is no doubt that it is one of the specimens upon which the description was founded in 1886.

Melitaea didyma mod. ***ambra*** mod. n. Plate 1 fig. 5 ♀; 6 ♂.

Mel. didyma dschungarica (Groum-Gr. *in litt.*) Oberth., 1909, *Ét. Lép. comp.* **3** : 243 et auct., *nec M. sibina dschungarica* Groum 1895.

Fore-wing ♂ 20–21 mm., ♀ 23 mm.

This is an insect of moderate size of which I have seen many specimens labelled " Dzun-

garia" and collected by Groum. The ground-colour of the upper surface is pale sandy yellow, and except in this respect it closely resembles the *neera* which fly in adjacent districts in the west. In the male the black spots on the upper surface are not large, and the disc of the hind-wings is often unmarked. On the under surface the black macules are clearly defined, but the ground-colour is very pale, and in particular the orange bands on the hind-wings are often so pale as to be scarcely visible, which gives a characteristic appearance. The female resembles the male, and is often even paler. The black discal spots on the fore-wings are sometimes very pronounced.

The facies of this exceptional modification strongly suggests a desert habitat, and it may be said to represent the extreme of paleness of ground-colour.

A form closely similar, if not identical, flies in the Amdo, of which there is a series in the British Museum collected by Groum in 1890. This represents the extreme eastern limit of the range of *didyma*. Another entirely different form more nearly resembling European *didyma* was also taken in the Amdo by Groum (Plate 1 fig. 12). Of this I have seen few specimens and there has been no opportunity of examining the genitalia. It appears to represent a mountain race, and is probably referable to *didyma latonigena*, but this point cannot be settled until more material is available.

The male holotype of *ambra* and twelve paratypes are in the British Museum (Natural History). All are labelled " Dzungaria Gr.-Gr."

Melitaea didyma ♀-form. ***cinerea*** form. n.

In this female form the upper surface of the fore-wings is more or less suffused with pale violet-grey. The pale yellow or white ground-colour may be entirely hidden, but as a rule it appears at least in the post-discal region or at the apex. The usual black markings are often small and look partly obscured by the grey suffusion. On the hind-wings the normal orange-red colour is present anteriorly, but posteriorly the grey shade takes its place. The under surface is not remarkable.

This interesting modification appears only in hot countries, in the mountains or as a spring generation in districts where *dalmatina* forms with yellow females occur at lower levels. The specimens are usually associated with rather small but bright orange-red males with reduced black pattern on the upper surface. The extensive suffusion shows a close relation to *meridionalis* and *alpina*. It may be regarded as the effect of modification by damp or cold upon pale southern races transitional to *dalmatina*. It is to be seen often in specimens from Sicily, but is best marked and most constant in the mountains of Asia Minor and northern Syria, where the winter is very severe. This modification does not occur in Africa nor in central Asia. It is curious that such a beautiful and striking form should be undescribed.

It is hoped to figure this form later in a supplementary plate. The holotype of *cinerea* is in the British Museum.

Melitaea didyma mixta Evans. Plate 2 fig. 6 ♂ paratype, 12 ♀.
Distribution Map 3, p. 183.

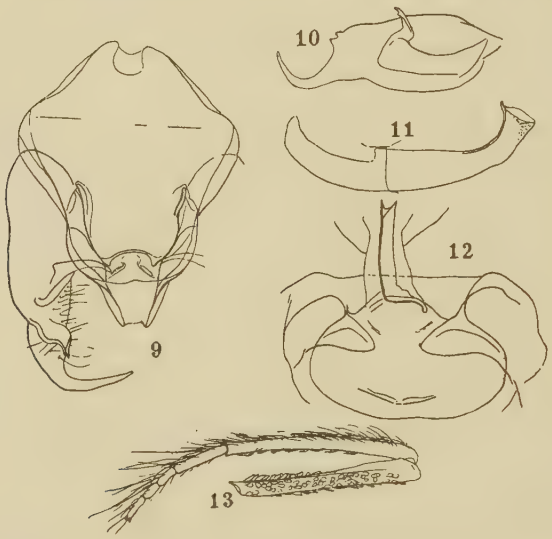
Mel. trivia race *mixta* Evans, 31.iii.1912, *J. Bombay nat. Hist. Soc.* **21** : 583. Loc. Chitral.
Mel. didyma mixta Evans, 1932, *Ident. Ind. Butt.* (Ed. 2) : 185.

Exp. alar. 32–36 mm.

This is an insect of small or medium size. The ground-colour in the male varies from reddish to pale yellowish-orange and in the latter case it closely resembles *didyma dalmatina*

Stgr. On the upper surface the discal spots of the hind-wings are usually fused to form a narrow black-elbowed fascia which is one of the most distinctive features. The well-developed marginal lunules often form a continuous series on both wings. On the under surface the orange submarginal fascia is conspicuously narrow in typical specimens. The female of this form is always pale and closely resembles the male.

The male genitalia (fig. 9) closely resemble those of *didyma*, and show the long posterior process to the clasp which appears as a rule in *turkestanica*. In the three examples examined, the harpe appears slightly shorter and straighter than usual. The spine of the clasp (fig. 10) is not prominent, and the penis (fig. 11) does not show any obvious charac-



Figs. 9–13.—*Melitaea didyma mixta* Evans. 9. Male genitalia, dorsal view. Chitral (mod. *problematica* Shelj.); 10. Clasp, lateral view. Chitral; 11. Penis, lateral view. Chitral; 12. Female genitalia, dorsal view. Chitral; 13. Male fore leg. Chitral.

teristic. The female genitalia (fig. 12) are not remarkable. The male fore tarsus (fig. 13) has been four-jointed in all specimens examined, and this is slightly different from typical *didyma*.

This is an insect of considerable interest and its true taxonomic position is not clear. I have dealt with it as a subspecies of *didyma* which it approaches very closely and which it apparently replaces in the Pamirs and the North-West Frontier mountains of India. If this is the correct systematic position, its standing is very different from that of the numerous modifications of this species already described. From its distribution it is obviously an insect of the high mountains, and unlike all other forms of *didyma*, it certainly occurs in the Alpine zone. I have seen the type form only from comparatively low elevations 5000–7000 ft., in Chitral. It is there very unstable and no doubt can exist only with difficulty. In a sense it is unfortunate that the name of this lowland race must take precedence over the much better characterised, and more widely distributed, high mountain forms next described.

Evans' description of *mixta* is very short and the references first to *trivia* and secondly to *didyma* are confusing. Fortunately the type specimen of *mixta* is in the British Museum so there can be no doubt of its identity. In the

short series of seven specimens are two transitional to, but much smaller than, the form *problematica* Shelj.

The specimen figured is a male paratype in which the markings are almost identical with the type, but the ground-colour is somewhat paler. It is probable that more than one brood appears at low elevations.

Localities :—Chitral 5000 ft., June (type Brit. Mus.); Chitral 5000 ft., April, Brit. Mus.; Chitral, no further data; 5 specimens Brit. Mus. and three others in coll. L.G.H.

Melitaea didyma mixta mod. ***problematica*** Shelj. Plate 3 fig. 8.

M. didyma problematica Sheljuzhko, 1929, *Mitt. Münch. ent. Ges.* **19** : 357. Loc. West Pamirs.

Exp. alar. 34–38 mm.

This insect is somewhat larger than typical *mixta*, and the markings are relatively stable. On the upper surface the ground-colour is darker reddish-orange. The black margin, particularly of the hind-wing, is wide and solid. A yellow costal mark is usually present near the apex of the fore-wings. On the under surface the orange submarginal fascia is narrow and has an even internal and external border of fine black crescents. In the female the black markings on the upper surface are more complete.

This form occurs at an elevation of 7000–10,000 ft. It forms a transition from typical *mixta* to the following form *nadezhdae*, from which it cannot be sharply differentiated. It is found in the Pamirs and is not rare in the higher mountains of Chitral.

Localities :—Pamirs, Chorog, Province of Shugnan, 7000 ft., June/July (Sheljuzhko (type)); Chitral, 9000 ft., June/July (Evans leg.); Gilgit, Ghizer, Sept. 1920, Drosh, May 1901, Gasin, Sept. 1924, Hailtar, July 1924.

Melitaea didyma mixta mod. ***nadezhdae*** Shelj. Plate 2 fig. 5 ♂, 11 ♀.

Mel. didyma nadezhdae Sheljuzhko, 30.vi.1912, *Deuts. ent. Z. Iris* **26** : 137. Loc. Pamirsky Post.

Exp. alar. 38–46 mm.

In this form the characters of *mixta* are well developed. The male is boldly marked and the yellow costal spot on the fore-wings is conspicuous. (This is not sufficiently prominent in the figure.) In the female on the upper surface the costa and outer margin of the fore-wing are pale and the submarginal lunules are strongly marked. This form is really more like typical *didyma* than is *problematica*.

I have not seen this insect from the Pamirs but have specimens from northern Chitral, taken at an elevation of about 12,500 ft. It is the only form of *didyma* which is known to occur in the Alpine zone. The female may be very large.

Localities :—Pamirs, Pamirsky Post (Sheljuzhko; type); North Chitral, Baroghil Pass, Hindu Kush, 3800 m., July, 4 ♂♂, 2 ♀♀, coll. L.G.H.; Boroghil, Sharwar-Shung; Yarkhun, July; Gilgit, Ouila-Sher, July/Aug. 1922.

Melitaea didyma latonigena Eversm. Plate 3 fig. 3 ♂; 9 ♀.
Distribution Map 3, p. 183.

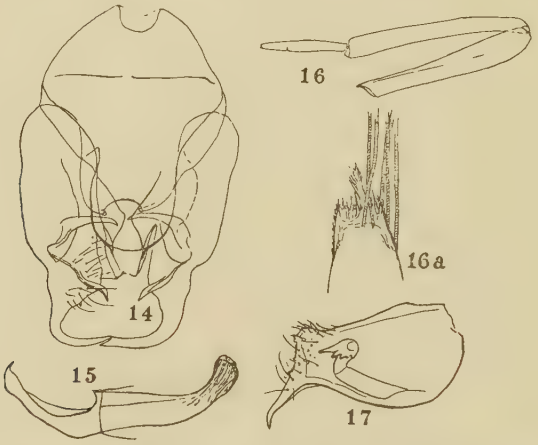
Mel. latonigena Eversmann, 1847, *Bull. Soc. Nat. Moscou* **20** (2) : 66, Pl. 1, fig. 1, 2. Loc. Kentei Mountains (?); *idem*, Fischer, 1851, *Entomographie Russ.* **5** : 71, Pl. 8, fig. 1, 2.

Exp. alar. 40–44 mm.

In the male the upper surface is rich tawny orange. The black marginal border of the hind-wings is wider than in typical *didyma*, and the discal spots of both wings are often

prominent. On the under surface of the fore-wings the first spot of the submarginal row (in cellule 2) is not often accentuated as is often the case in *didyma*. On the hind-wing the black markings are finer and more continuous and some or all of the nervures are commonly outlined with black scales. In the females, which are strongly melanic, the ground-colour on the upper surface is pale cream. There is nearly always a wide pale fascia behind the disc of the hind-wings. On the under surface a series of pale macules is commonly present in the dusky yellow submarginal fascia.

The male genitalia (fig. 14) closely resemble those of *didyma* but show a small difference in that the posterior process of one clasp, usually the right, is flattened and excavated to receive the process of the opposite side.



Figs. 14.–17.—*Melitaea didyma latonigena* Eversm. 14. Male genitalia, dorsal view. Sajan Mts. (mod. *atrata* Hig.); 15. Penis, lateral view. Altai Mts.; 16. Fore leg male, Altai Mts.; 16a. Male fore-foot more magnified. Showing the terminal comb bases of five tarsal hairs; 17. Clasp, lateral view. Altai Mts.

There is obvious asymmetry in the male genitalia of this subspecies which is very unusual in Nymphalid butterflies, but I have seen the same character well marked in an undoubted *didyma* from the Taurus. The penis (fig. 15) in *latonigena* is also straighter and the proximal curve in particular is less pronounced. In lateral view there is another small difference in the clasp (fig. 17) which is usually slightly constricted into a " neck " in front of the posterior process, and the spine is very prominent. The male fore tarsus (fig. 16) usually shows two imperfectly formed components. The end of the fore-foot is illustrated especially magnified in fig. 16a. The small brush-like structure may be seen arising from the tarsal apex, surrounded by a ring of fine bristles (see p. 176). The base of five of the long tarsal hairs is also shown, but others are omitted in order to display the terminal structures.

I have seen this form only from the Kentei Mountains. The black and white female is not by any means a chance aberration as has often been suggested. On the contrary the fascies is very constant, and is well illustrated in the plate accompanying Eversmann's description. The figure in the *Entomographie* is not quite so good.

This interesting insect is clearly a very close ally of *didyma*. In the male sex the two are often difficult to differentiate, particularly the forms met with in the Altai. Farther east the differences are more pronounced, and in the

Sajan Mountains and the more northern districts of its range, *latonigena* develops a very distinct facies which is not likely to be confused with any other species. In eastern Siberia it replaces *didyma*, of which I have seen typical specimens only from Katuna in the north-west Altai. Elsewhere in the central Altai, Changai and Sajan Mountains only *latonigena* occurs, which becomes more differentiated as it spreads eastwards. I can find no evidence that *didyma* occurs anywhere within the range of *latonigena* so it seems as if the forms should be treated as subspecies.

This insect flies principally in the mountains. I have seen various records of altitude varying from 3000 to 6000 ft. It is probably a subalpine insect, and this suggestion is supported by the rich orange colour of the males and by the melanic females. The small amount of material available suggests an unusual degree of local differentiation. It is probable that four recognisable and relatively stable forms have developed in the various mountain ranges in the wide distribution area. These probably vary a good deal according to elevation. There are in the British Museum three small specimens from the Altai at 6000 ft. which cannot be distinguished from the form *polaris* of Verchojansk.

It is not likely that *latonigena* will be confused with any other species. In many districts it is accompanied by *didymoides*. The specific separation of the two butterflies was pointed out again by Dorries (Staudinger, 1888, *Deuts. ent. Z. Iris* **5** : 324), who found both insects flying together in the same mountain meadows in the Kentei Mountains at an elevation of 6000 ft.

Localities :—Kentei Mountains. A good many specimens without further data; Kiachta, ex coll. Felder. Tring, one female.

Melitaea didyma latonigena mod. ***altaica*** Grum. Plate 3 fig. 2 ♂.

Mel. didyma var. *altaica* Grum Grshmailo, 1893, *Hor. Soc. ent. ross.* **27** : 127. Loc. :—Altai Mts.

Exp. alar. 38–42 mm.

This form differs from typical *latonigena* in its slightly smaller size. In the male the markings on the under surface of the hind-wings are finer and more delicate. The discal spots are prominent in both sexes. In the female the pale fascia behind the disc of the hind-wings is not prominent.

The type specimen of *altaica* is in the British Museum. It is a female in which the ground-colour of the upper surface is orange-red. The form in which the ground-colour is pale cream is much commoner. This sex is very variable and runs into typical *didyma*.

I have seen several male specimens from the Khangai (Changai) Mountains which may be included with this form. The difference from typical *latonigena* is slight, but *altaica* is of interest as it shows the first transition from true *didyma*.

Localities :—Altai Mountains : Ongodai, 3000–5000 ft., 2 July 1898 (Brit. Mus.); Arason, 6000 ft., very small, Brit. Mus.; S.E. Altai : Tchuja Valley, 4000–6000 ft., 20 July 1898, Brit. Mus.; Bashkaus, 3000–4000 ft., 26 July 1898, Brit. Mus.; Transbaical : Apfelgebirge, series in Tring Museum; Changai Mountains : several specimens without further data.

Melitaea didyma latonigena mod. ***atrata*** Higgins. Plate 3 figs. 4, 10.

Mel. latonigena atrata Higgins, 1935, *Entomologist* **68** : 112. Loc. Sajan Mountains.

Exp. alar. 36–40 mm.

This is a smaller form. In the male sex the markings are more complete and in particular the post-discal spots are well developed on both wings, the marginal border wide,

and the black submarginal lunules regular and complete. On the under surface of the hind-wings the nervures 2, 3 and 4 and frequently others are firmly outlined with black scales. The female specimens I have seen are almost entirely black on the upper surface.

Locality :—East Sajan Mountains : Turkinsk Weissberge, 2000 m., July.

Melitaea didyma latonigena mod. ***polaris*** Grum. Plate 3 fig. 5 ♂, 11 ♀.

Mel. didyma var. *polaris* Groum Grshmailo, 1899, *Annu. Mus. zool. St. Petersb.* **4** : 459. Loc. Verchojansk.

Exp. alar. 36–42 mm.

This small form most resembles *atrata*, but usually differs in the absence of the post-discal spots of both wings. The markings of the under surface are fine and regular. The veins of the hind-wings are usually outlined by black scales and the pale macules in the orange submarginal band are obvious in both sexes. The ground-colour of the females is whitish, often mixed with orange near the outer margins of the wings.

The form *polaris* nearly reaches the Arctic circle, and extends farther north than any other member of the genus. I have seen only a few specimens and have not been able to examine the genitalia. This butterfly is probably widely distributed north of the Amur valley. The apparent small size is due chiefly to the narrow, less ample wings.

Localities :—Jakutsk : Shigansk, 7–25 June 1901, Brit. Mus.; Verchojansk, Jana Valley, 12–14 July 1901, Brit. Mus.

In the following alphabetic list of the named varieties of *Melitaea didyma* I have included notes indicating their applicability.

aabaca *M. didyma aabaca* Fruhst., 1917, *Soc. Ent.* **32** : 19. Loc. Spain—Castille. According to Belter (1934, *Arb. morph. tax. Ent.* **1** : 114) this should be referred to *trivia* and the locality is really Anatolia. A pale form.

acrogynoides *M. didyma* O. ab. *acrogynoides* Reverdin, 1910, *Bull. Soc. Lép. Genève* **2** : 47 (fig.). Loc. Berisal. Aberrational form with three pale macules at the apex of the fore-wing.

aestiva *M. didyma variabilis aestiva* Belter, 1934, *Arb. morph. tax. Ent.* **1** : 108. Loc. Brussa. An *occidentalis* form. A name for the second generation of *d. variabilis*.

alaeida *M. didyma* form *alaeida* Stauder, 1925, *Ent. Anz.* **5** : 43. Loc. Tirol—Sillschlucht etc. Aberrational form, resembling *ala*. The basal markings diminished, distal markings accentuated.

albescens *M. didyma* ♀ form *albescens* Verity, 1916, *Bull. Soc. ent. ital.* **48** : 184. No locality cited. A name for nearly white females.

albicans *M. didyma* ab. *albicans* Pieszczek, 1909, *Jahresb. wien. ent. Ver.* **19** : 85. Loc. Judenberg. Aberrational form. The usual black markings appear silver-grey.

alpina *M. didyma* var. *alpina* Stgr. 1861, *Cat.* (Ed. 1.) : 8. Forma tempestatis ? Small specimens with dark females found at high altitudes. Cited as a female variety by Stgr. See p. 204.

ambra *M. didyma ambra* (nom. n. pro *dschungarica* Gr.). See p. 208.

androtropia *M. didyma* forma *androtropia* Fruhst., 1917, *Arch. Naturg.* **82** (A) (2) : 9. No locality cited. A name for reddish male-like females. These are characteristic of *occidentalis*,

apennigena *M. didyma apennigena* Verity, 1919, *Ent. Rec.* **31** : 181. Loc. Apennines above Lucca. A mountain race corresponding to *alpina* Stgr. but the characters less marked.

armoricana *M. didyma* forma *armoricana* Oberth., 1909, *Ét. Lép. comp.* **3** : 241. Loc. Bretagne—France. A narrow-winged race with the females usually orange, approaching *occidentalis*. See p. 204.

atralpina *M. didyma atralpina* Verity, 1929, *Ent. Rec.* **41** : 89. Loc. ? Tirol. I am unable to fix the description to which this name refers. It is best treated as a *nomen nudum*.

atrarubra *M. didyma* ab. *atrarubra* Vrty, 1929, *Ent. Rec.* **41** : 75. Loc. Intra. Aberrational form. On the under surface the pale ground-colour is replaced by black.

bockleti *M. didyma* ab. *bockleti* Heuer, 1924, *Int. ent. Z.* **17** : 170. Loc. not cited. "Narkoseform." Pattern much distorted.

bosphorana *M. didyma* O. var. *bosphorana* Culot, 1906, *Bull. Soc. Lép. Genève* **1** : 166. Loc. Bosphorus. A small form with marked *dalmatina* characters and pale females. Second generation. Probably a synonym of *dalmatina* Stgr.

boulei *M. didyma* form *armoricana* var. *boulei* Oberth., 1909, *Ét. Lép. comp.* **3** : 241. Loc. Bretagne—France. Aberrational form (recurrent). Ground-colour yellowish in both sexes.

calcea *M. didyma calcea* Skala, 1928, *Z. österr. ent. Ver.* **13** : 87. "Flying on limestone." The characters not specified.

caldaria *M. didyma caldaria* Vrty, 1920, *Boll. Lab. Zool. gen. Portici* **14** : 59. Loc. Florence. Very small and pale fulvous. Name for the second generation of the Florentine *protea*. Trans. ad *dalmatina*.

castiliana *M. didyma* v. *castiliana* Melcon, 1910, *Bol. R. Soc. espan. Hist. nat.* **10** : 219. Loc. Cuenca—Castille. An *occidentalis* form very like *neera*. No black dusting at the wing-bases. Name not valid.

cataminuta *M. didyma cataminuta* Vrty, 1929, *Ent. Rec.* **41** : 118. Loc. Catalonia, Spain—Barcelona. Very small and dull ochreous in colour. Probably third generation of *cataprotea*.

cataoccasus *M. didyma cataoccasus* Vrty, 1929, *Ent. Rec.* **41** : 118. Loc. Barcelona. Rather pale. The second emergence of *cataprotea* Vrty.

cataprotea *M. didyma cataprotea* Vrty, 1929, *Ent. Rec.* **41** : 117. Loc. Barcelona. An *occidentalis* form. The males intense orange, the females very pale, with regular pattern.

cinerea *M. didyma* forma ♀ *cinerea*. See p. 209.

crasnensis *M. didyma* var. *crasnensis* Hormuz., 1894, *Ent. Nachr.* **20** : 1. A mountain form showing *meridionalis* characters. Genitalia slightly asymmetrical. See p. 199.

cumulans *M. didyma* ab. *cumulans* Skala, 1928, *Z. österr. ent. Ver.* **13** : 86. Loc. not specified. Aberrational form. The discal marks of the hind-wings extended radially.

dalmatina *M. didyma* var. *dalmatina* Stgr., 1861, *Cat.* (Ed. 1) : 8. Loc. Ragusa. A small pale form with *occidentalis* characters. See p. 206.

demaculata *M. didyma* ab. *demaculata* Bramson, 1910, *Hor. Soc. ent. ross.* **39** : 395. Loc. ?. Aberrational form. The under surface of the fore-wings almost free from markings. (Described but not named by Abafi-Aigner, 1906, *Ann. Mus. nat. Hung.* **4** : 493.)

depauperata *M. didyma* ab. *depauperata* Sagarra, 1924, *Trab. Mus. Ci. nat. Barcelona* **11** : 14. Loc. Barcelona. Aberrational form. Fore-wings

almost free from markings, but those of hind-wings fused into radiating streaks.

diluta *M. didyma* ab. ♀ *diluta* Bramson, 1910, *Hor. Soc. ent. ross.* **39** : 405. Loc. Abruzzi—Italy. Female aberration. Ground-colour yellow-brown. Like female *alpina* but without the black dusting. Described but not named by Calberla 1887, *Deuts. ent. Z. Iris* **4** : 132.

discolor *M. didyma* ab. ♀ *discolor* Bramson, 1910, *Hor. Soc. ent. Ross.* **39** : 406. Loc. not cited. Female aberration. The discal spots strongly reduced. Described but not named by Abafi-Aigner, 1906, in *Ann. Mus. nat. Hung.* **4** : 494.

druentia *M. didyma druentia* Fruhst., 1917, *Arch. Naturg.* **82** (A) (2) : 8. Loc. Bosnia. A deep red well-marked race near *graeca* Stgr.

dschungarica *M. didyma dschungarica* Gr.-Gr. No reference traced but quoted by Turati, 1919 (1920), *Nat. Sicil.* **31** : 226. Probably not valid, as preoccupied by *M. sibina dschungarica* Gr.-Gr. 1895. Quoted also by Oberth., 1909, *Ét. Lép. comp.* **3** : 243. See *M. didyma ambra* nom. n.

elevar *M. didyma elevar* Fruhst., 1917, *Arch. Naturg.* **82** (A) (2) : 11. Loc. Sarafschan—Dukdan. A rather small *occidentalis* form near *dalmatina*.

emicandida *M. didyma* ab. *emicandida* Verity, 1911, *Bull. Soc. ent. ital.* **42** : 266. Loc. Vallambrosa (fig.). The ground-colour partly white. Aberrational form.

eutitania *M. didyma eutitania* Fruhst., 1917, *Arch. Naturg.* **83** (A) (6) : 13. Loc. Pegli—Liguria. Very large but pale specimens of marked *occidentalis* type. Females all yellow, not green shaded.

fasciata *M. didyma* ab. ♂ *fasciata* Skala, 1907, *Ent. Z. Guben* **20** : 310. Loc. not cited. Described as a male aberration. On the upper surface the discal macules of the fore-wings are fused into a fascia. The name is preoccupied by *M. dictynna fasciata* Lambil. 1906.

fasciata *M. didyma* f. *fasciata* Vorbrodt, 1917, *Mitt. schweiz. ent. Ges.* **12** : 521. Appears to be an aberration similar to that described above.

fischeri *M. didyma* ab. ♀ *fischeri* Abafi-Aigner, 1906, *Ent. Z. Guben* **19** : 208. Loc. Hungary. On the upper surface the markings collected into an uneven black field near the bases. Other parts of the wings nearly free from markings.

fulvocincta *M. didyma* ab. ♂ *fulvocincta* Bramson, 1910, *Hor. Soc. ent. ross.* **39** : 393. Locality not cited. Described as a male aberration. The wings suffused with dark brown, except near the outer margins. Described but not named by Abafi-Aigner, 1906, *Ann. Mus. nat. Hung.* **4** : 495.

garumna *M. didyma garumna* Verity, 1929, *Ent. Rec.* **41** : 72. Loc. S.W. France (Vernet). A large brightly coloured form with pronounced *occidentalis* features. The second generation named *postgarumna* Vrty.

georgi *M. didyma* gen. 3 *georgi* Fruhst., 1916, *Arch. Naturg.* **82** (A) (2) : 10. Loc. Tessin. Described as third generation. Small specimens, yellow-brown in both sexes, with characters of *dalmatina*. See *ignaea* Vrty.

graeca *M. didyma* var. *graeca* Stgr., 1870, *Hor. Soc. ent. ross.* **7** : 60 (fig.). Loc. Karpinisi—Greece. A heavily marked *meridionalis* form, the males intense orange-red, the females greenish. See p. 204.

graeciformis *M. didyma protea* form *graeciformis* Vrty, 1916, *Bull. Soc. ent. Ital.* **48** : 183. Loc. Elba—Poggio. Stated to agree perfectly with *graeca* Stgr.

griseo-fusca *M. didyma* ab. ♀ *griseo-fusca* Bramson, 1910, *Hor. Soc. ent. ross.* **39** : 404. Loc. not cited. Most of the wings suffused with greyish-brown.

Described but not named by Abafi-Aigner, 1906, *Ann. Mus. nat. Hung.* **4** : 495. A female aberration.

hiberava M. didyma ab. *hiberava* Verity, 1929, *Ent. Rec.* **41** : 130. Loc. Arragon—Spain. Female aberration. A female with some greenish shading although Spanish.

hoffmanni M. didyma ab. *hoffmanni* Skala, 1908, *Ent. Z. Guben* **21** : 268. Nom. n. pro *radiata* Skala 1907 *nec* Aigner 1906. The insect is referable to *trivia*, cf. Skala, 1912, *Verh. Naturf. Ver. Brunn* **50** : 109.

ignaea M. didyma ignaea Verity, 1929, *Ent. Rec.* **41** : 74. Loc. Maggiore—Intra (plains). A large brilliant race, tending towards *occidentalis*. Possibly the first generation of Fruhstorfer's *georgi*.

interposita M. didyma interposita Rothsch., 1913, *Novit. Zool.* **20** : 115. Loc. Algeria—Aures Mts. A well-marked form with darker ground-colour than most African races. Very near *variabilis* Belter.

interrupta M. didyma ab. *interrupta* Skala, 1907, *Ent. Z. Guben* **20** : 311. Loc. Nikolsburg. On under surface of the hind-wings the basal red fascia broken into small spots. Reported by Skala also in *cinxia* and in *trivia*.

inversa M. didyma inversa Skala, 1928, *Z. österr. ent. Ver.* **13** : 85. No loc. cited. The ground-colour is black all over.

jaica M. didyma ab. ♂ *jaica* Krulikowsky, 1901, *Mat. pozn. Faun. fior. Ross. Imp.* **6** : 31 (fig.). Loc. Kasan. Narrow fore-wings. The black spots large, the submarginal macules elongated and fused. A male aberration.

kasanskyi M. didyma var. *kasanskyi* Krulikowsky, 1901, *Mat. pozn. Faun. fior. Ross. Imp.* **6** : 30 (fig.). Loc. Russia—Vladimir. Near *neera*. The ground-colour brownish, the black macules paler than usual. A second generation.

kaschtschenkoi M. didyma var. *kaschtschenkoi* Christoph, 1889, *Ent. Nachr.* **15** : 69. A synonym of *caucasica* Stgr. *q.v.* This was agreed by Christoph *loc. cit.* : 296.

kempeleni M. didyma ab. ♀ *kempeleni* Abafi-Aigner, 1906, *Ent. Z. Guben* **19** : 208. Loc. Hungary. Female aberration. Many of the black macules enlarged, some into streaks. Marginal area almost free from markings.

latefascia M. didyma alpina ab. ♀ *latefascia* Bramson, 1910, *Hor. Soc. ent. ross.* **39** : 393. Female aberration. On the fore-wings the discal spots united into a band, and the outer margin wide.

latefasciata M. didyma latefasciata Vorbrodt & Müller-Rutz, 1916, *Mitt. schweiz. ent. Ges.* **12** : 435. Fore-wings almost entirely black. A single central yellow macule, and a narrow orange marginal band. A heat form (*cf.* Standfuss, 1899, *Zool. Studien* **4** : 10).

latolimbata M. didyma ab. *latolimbata* Sovinsky, 1927, *Trav. Stat. biol. Dniepre* **2** : 381. nom n. pro *marginata* Ksienzh. *nec* Skala 1907.

latonigenoides M. didyma ab. *latonigenoides* Kesenheimer, 1921, *Ent. Rundsch.* **38** : 38. Loc. Frankfurt. Aberrational form.

leopardata M. didyma leopardata Verity, 1924, *Ent. Rec.* **36** (Suppl.) : 37. Loc. Elba. A large *meridionalis* form, the pattern very complete. Second generation. Occurs also at Florence with *caldaria*.

lesora M. didyma lesora Fruhst., 1917, *Arch. Naturg.* **82** (A) (2) : 8. Loc. Laibach. A *meridionalis* form with exaggerated black macules, often confluent.

libanotica M. didyma libanotica Belter, 1934, *Arb. morph. tax. Ent.* **1** : 106. Loc. N. Lebanon. Medium size and pale colour. Transitional to *dalmatina*.

lilliputana *M. didyma* var. *lilliputana* Oberth., 1909, *Ét. Lép. comp.* **3** : 244. Loc. Syria—Akbes. Small and weakly marked, probably identical with *dalmatina*. Probably 2nd gen.

livida *M. didyma* ab. *livida* Klemensiewicz, 1906, *Verh. zool.-bot. Ges. Wien* **56** : 160 (fig.). Aberrational form. The ground-colour pale cream. Identical with *pudica* Stichel 1901 *teste* Skala, 1910, *Verh. Naturf. Ver. Brunn* **49** : 107.

magnaestiva *M. didyma magnaestiva* Vrty, 1929, *Ent. Rec.* **41** : 76. Loc. Montpellier. An *occidentalis* form. The second gen. The first gen. is identical with *subpatycosana* Vrty *q.v.*

majellensis *M. didyma* ab. *majellensis* Dannehl, 1927, *Mitt. Münch. ent. Ges.* **17** : 2. Loc. Abruzzi—Majella. A small pale form near *dalmatina*, with orange females.

marginata *M. didyma* ab. ♂ *marginata* Skala, 1907, *Ent. Z. Guben* **20** : 310. Loc. Nikolsburg. Described as a male aberration. The black border very wide.

marginata *M. didyma* ab. *marginata* Ksienschopolsky, 1912, [*Werke Ges. Erf. Wolh.*] *Trdi Obsc. izsl. Volyni Zitomir* **8** : 37 (fig.), *nec marginata* Skala 1907. See *latolimbata* Sovinsky.

marginimaculata *M. didyma* ab. *marginimaculata* Kautz, 1919, *Verh. zool.-bot. Ges. Wien* **69** : 122. Loc. ?. The submarginal macules fused with the marginal line. Aberrational form.

mariannae *M. didyma mariannae* Skala, 1928, *Z. österr. ent. Ver.* **13** : 85. Loc. Liegnitz. The submarginal orange fascia on the under surface of the hind-wings reduced to small spots ringed with black scales.

marsilia *M. didyma marsilia* Fruhstorfer, 1917, *Arch. Naturg.* **82** (A) (2) : 9. Loc. Riviera. Small specimens slightly more heavily marked than *dalmatina*. Probably a second generation.

mauretanica *M. didyma mauretanica* Oberth., 1909, *Ét. Lép. comp.* **3** : 243. Loc. southern Spain and Algeria. Black markings well developed, but strong *occidentalis* characters. Verity, 1919, *Ent. Rec.* **31** : 180, restricts this name to the first brood figs. 2301–2302, and names the second brood *occasus* q.v.

mauritii *M. didyma* ab. *mauritii* Reverd., 1918, *Bull. Soc. Lép. Genève* **4** : 40. Loc. Simplon. The black macules on the disc of the fore-wing are enlarged and confluent. Although an aberration, this is an extreme development of the predominant character in the locality.

meridionalis *M. didyma* var. *meridionalis* Stgr., 1870, *Hor. Soc. ent. ross.* **7** : 60. Loc. Greece—Parnassus. The ground-colour vivid, with heavy black markings. The females with greenish suffusion. See p. 204.

microleopardata *M. didyma microleopardata* Verity, 1929, *Ent. Rec.* **41** : 76. Loc. S. France—Lot. Resembles *leopardata* but smaller and dull in colour.

minor *M. didyma* ab. *minor* Ksienschopolsky, 1911, [*Werke Ges. Erf. Wolhynia*] *Trd. Obsc. izsl. Volyni Zitomir* **8** : 37 (fig.). Name for small specimens from this locality. Loc. Wolhynia.

mireio *M. didyma* ab. *mireio* Foulquier, *in* L'Homme, 1923, *Cat. Lép. France* : 60. Loc. Camargue. On both surfaces the fawn colour replaced by white. Aberrational form.

moulinsi *M. didyma* ab. *moulinsi* Trimoulet, 1924, *Bull. Soc. Linn. Bordeaux* **22** : 17. The markings large. The ground-colour pale fawn. Compare *livida* Klemen. and *boulei* Ob.

naina *M. didyma naina* Fruhst., 1917, *Arch. Naturg.* **82** (A) (2) : 8. Loc. Klausen. Bright colour with small markings. The females usually shaded darker.

neera *M. didyma* var. *neera* Fischer de Waldheim, 1840, *Bull. Soc. Nat. Moscou* **1840** (1) : 81. Loc. S. Russia. A large form of *occidentalis* type, the black markings somewhat reduced. See p. 207.

neeraeformis *M. didyma neeraeformis* Vrty, 1913, *Bull. Soc. ent. ital.* **45** : 212. Loc. Calabria. An *occidentalis* form of large size and brilliant colouring.

nigerrima *M. didyma* ab. ♀ *nigerrima* Schultz, 1908, *Ent. Z. Stuttgart* **22** : 91. Loc. ?. Aberrational female form. The black markings so much extended that the pattern is scarcely visible. See also *inversa* Skala.

nigra *M. didyma* ab. *nigra* Balestre, 1903, *Bull. Soc. ent. Fr.* **18** : 306. Loc. Alpes Maritimes. Very melanic, with only two small orange macules on the fore-wings. See also *latefasciata* Vorbt. and *stupenda* Nitsche.

nigra *M. didyma* ab. *nigra* Skala, 1907, *Ent. Z. Guben* **20** : 310. Loc. Nikolsburg. The black pattern accentuated, the post-discal macules clearly developed on the fore-wing. See *nigrita* Skala.

nigralba *M. didyma* ab. *nigralba* du Couedic, 1934, *Lambillionea* **34** : 150. Loc. Hautes Alpes.

nigrita *M. didyma* ab. *nigrita* Skala, 1908, *Ent. Z. Guben* **21** : 268. nom. n. pro *nigra* Skala 1907 *nec* Balestre 1903.

nigroguttata *M. didyma* ab. *nigroguttata* Sovinsky, 1927, *Trav. Stat. biol. Dniepre* **2** : 381. nom. n. pro *striata* Ksiens. 1911 *nec* Skala 1907.

nigrorubida *M. didyma nigrorubida* Vrty, 1919, *Ent. Rec.* **31** : 180. Loc. Saxony. A large and heavily marked form.

nisseni *M. didyma nisseni* Rothsch., 1913, *Novit. Zool.* **20** : 115. Loc. N. Algeria and Tunis. An *occidentalis* form with pale ground-colour and the black pattern very complete. Probably synonymous with *mauretanica* Ob.

nominoe *M. didyma* ab. *nominoe* Oberth., 1900, *Bull. Soc. ent. Fr.* **1900** : 276. (Fig., 1909, *Ét. Lép. comp.* **3** : 136.) Loc. Ille-et-Vilaine. Aberrational form. Most of the discal markings absent.

oblongomaculata *M. didyma* ab. *oblongomaculata* Skala, 1908, *Ent. Z. Guben* **21** : 238. Aberrational form. Post-discal, submarginal and marginal lunules strongly developed and often cuneiform.

occasus *M. didyma occasus* Vrty, 1919, *Ent. Rec.* **31** : 180. Loc. N. Africa. Name for the second brood of *mauretanica* Ob. Type fig. 2299–2300 of 1914, *Ét. Lép. comp.* **10**.

occidentalis *M. didyma* var. *occidentalis* Stgr., 1861, *Cat.* (Ed. 1) : 8. Loc. Western Europe. The western race with females of the same colour as the males. The name defined by Stgr., 1870, *Hor. Soc. ent. ross.* **7** : 60.

ocellata *M. didyma* ab. ♀ *ocellata* Skala, 1907, *Ent. Z. Guben* **20** : 311. Loc. Nikolsburg. Aberrational form. The post-discal and submarginal lunules fuse to divide the submarginal fascia into a series of rounded spots.

ochracea *M. didyma* ab. *ochracea* ♀. Skala, 1908, *Ent. Z. Guben* **21** : 238. Loc. not cited. The under surface light yellow ochre. A female aberration.

ochracea *M. didyma* forma *ochracea* Fruhst., 1916 (1917), *Arch. Naturg.* **82** (A) (2) : 9. A name for pale yellow or ochreous females. These occur in *occidentalis* forms.

oreithyia *M. didyma oreithyia* Fruhst., 1917, *Arch. Naturg.* **82** (A) (2) : 7. Loc. North Adriatic—Fucine. A large form with bright ground-colour and heavy markings. Females usually light.

orientalis *M. didyma* var. *orientalis* Herrich-Schaeffer, 1856, *Syst. Bearb. Schmett. Europ.* **6** : 4. (?), Locality not cited. *nec orientalis* H.-S. 1845.

pallida *M. didyma* ab. ♀ *pallida* Skala, 1907, *Ent. Z. Guben* **20** : 311 (cf. *Ent. Z. Guben* **13** : fig. 3). Ground-colour very light and markings reduced on outer third of both wings.

palustris *M. didyma palustris* Verity, 1919, *Ent. Rec.* **31** : 181. Loc. Italy—River Arno. A large race with heavy black markings and the females unusually suffused, near *meridionalis*.

parvalpina *M. didyma parvalpina* Verity, 1928, *Ent. Rec.* **40** : 163. Loc. Clavieres—Cottian Alps. An alpine race of very small size. Probably identical with *alpina* Stgr.

patycosana *M. didyma* var. *patycosana* Turati, 1911, *Annu. Mus. zool. Napoli* (n.s.) **3** (18) : 18. (fig. 1919, *Nat. Sicil.* **31**, Pl. 2 fig. 13–14.) A large and brilliant race with suffused females. A *meridionalis* form, but Stauder (1914, *Z. wiss. InsectenB.* **10** : 373, fig.) says that half the females are orange and not at all suffused.

pieszczeki *M. didyma* ab. *pieszczeki* Skala, 1909, *Ent. Jahrbuch.* **19** : 136. Loc. ?. Submarginal spots confluent, and shot with violet. An aberrational form.

postgarumna *M. didyma postgarumna* Verity, 1929, *Ent. Rec.* **41** : 72. Loc. France—Gironde. The second generation of *garumna* Vrty. Ground-colour paler and the markings less extensive.

postoreithyia *M. didyma postoreithyia* Verity, 1929, *Ent. Rec.* **41** : 91. Loc. Trieste. The second generation of *oreithyia* Fruhst. The distinctive characters are not apparent from the description.

praemarsilia *M. didyma praemarsilia* Vrty, 1929, *Ent. Rec.* **41** : 74. Loc. Mountains round Lake Maggiore—N. Italy. Ground-colour light fulvous, markings complete but small. Recorded also from southern France and from Bulgaria.

progressiva *M. didyma* ab. *progressiva* Ksienschopolsky, 1912 [*Werke Gesell. Erf. Wolh.*] *Trd. Obsc. Izsl. Volnyi Zitomir* **8** : 37 (fig.). The work is not available, and the description cannot be traced elsewhere. See also *M. diamina progressiva*.

protaeoccidentis *M. didyma protaeoccidentis* Verity, 1929, *Ent. Rec.* **41** : 117. Loc. Morocco. Like *occidentalis* but the colour is less bright and the black markings more pronounced.

protea *M. didyma protea* Verity, 1916, *Boll. Soc. ent. ital.* **48** : 184. Loc. Tuscany. The ground-colour fiery red, the black pattern reduced. Near *occidentalis*. See p. 201.

pudica *M. didyma* ab. *pudica* Stichel, 1901, *Berlin. ent. Z.* **46** : 23. Loc. Switzerland. The ground-colour partly white, especially on the fore-wings. See also *emicandida* Vrty and *livida* Klem.

pumila *M. didyma pumila* Vrty, 1919, *Ent. Rec.* **31** : 181. No locality cited. A name for dwarf specimens. Aberrational form.

pyrenealpina *M. didyma pyrenealpina* Verity, 1929, *Ent. Rec.* **41** : 73. Loc. Gedre—Pyrenees. Spots scanty and females suffused. Most males exactly like *subalpina*, a few like *armoricana*. (This does not agree with my own series.)

radiata *M. didyma* ab. ♂ *radiata* Abafi-Aigner, 1906, *Ann. Mus. nat. Hung.* **4** : 493 (fig.). Male aberration. Fore-wings marked with brown macules, and all black spots united into longitudinal streaks. Cf. *radiata* Skala.

radiata *M. didyma* ab. *radiata* Skala, 1907, *Ent. Z. Guben* **20** : 310. (*Ent. Z.* **13**, fig. 1.) Should be referred to *trivia* vide 1912, *Verh. Naturf. Ges. Brunn* **50** : 47.

radiata *M. didyma* ab. *radiata* Oberth., 1909, *Ét. Lép. comp.* **3** : fig. 137, 140. Synonym of *radiata* Abafi-Aigner.

ravalpina *M. didyma ravalpina* Verity, 1929, *Ent. Rec.* **41** : 90. Loc. Schnalsertal. Near *alpina*. The males small, the females greyish and not very black. A high level race.

rebrensis *M. didyma rebrensis* Gusic, 1917, *Glasnik Hrvat. prirod. Drust. Zagreb* **1917** : 216. Loc. Rebro—Zagreb. Very small, the macules extended, and a wide black border round all wings. Eight specimens known. ? form. temp.

rectealpina *M. didyma rectealpina* Verity, 1929, *Ent. Rec.* **41** : 66. Loc. Bormio—Liguria. Near *alpina* Stgr. Males said to be identical with typical *didyma*. Probably synonym of *alpina*.

roccii *M. didyma roccii* Turati, 1919 (1920), *Nat. Sicil.* **23** : 228. Loc. Monte Maggio—Genoa. *occidentalis* form. The ground-colour pale, the black spots sparse and small. Second generation.

romana *M. didyma* var. *romana* Calberla, 1887, *Deuts. ent. Z. Iris* **4** : 132. Loc. Roman Campagna. Near *occidentalis*. A pale form of small size taken in May and June in the Campagna. Tends towards *dalmatina*. Verity suggests that the name should be used for the second brood of southern Europe (1919, *Ent. Rec.* **31** : 181). Best classed as forma alicujus loci. See p. 201.

romula *M. didyma* Esp. race *romana* Calb. gen. 2 *romula*, Verity, 1922, *Ent. Rec.* **34** : 12. Loc. Genzano near Rome. A name for the second brood of *romana* Calb., which is stated to be scarcely different from the first brood. See p. 201.

rubida *M. didyma* gen. 1 *rubida* Verity, 1919, *Ent. Rec.* **31** : 179. Loc. Paris. A name for the first generation of the northern race. Verity takes Esper's fig. Pl. XLI fig. 3 to represent the second brood, which he specifies as typical. He says that Pl. LXI fig. 1 represents the first brood of Paris, and makes this the type of his *rubida*.

seilemis *M. didyma seilemis* Fruhstorfer, 1917, *Arch. Naturg.* **82** (A) (2) : 9. Loc. Alpes Maritimes. A *meridionalis* form. The males dark red, the spots well marked. Most females suffused.

siberica *M. didyma* var. *siberica* Heyne, 1893, *Pal. Grossschmet.* : 394. Loc. Southern Amur. A synonym of *sutschana* Stgr. (*loc. cit.* : 789). Preocc. by *M. artemis siberica* Stgr. 1861.

sicula *M. didyma* O. ss. *sicula* Stauder, 1928, *Lep. Rundsch.* **2** : 107. Loc. Palermo and Cinisi. Near *dalmatina*. The males small and weakly marked, the females usually mousy grey. The name is preocc. by *M. athalia sicula* Turati 1915. Rothschild and Verity employ the name *occidentalis* for this form.

speciosa *M. didyma* ab. *speciosa* Schultz, 1908, *Ent. Z.* **22** : 91. Loc. Sarepta (?). Female aberration showing a violet reflection on the upper surface.

striata *M. didyma* ab. *striata* Skala, 1907, *Ent. Z. Guben* **20** : 310. Loc. Nikolsburg. An aberrational form. The marginal lunules of both wings fused with the rather wide marginal border.

striata *M. didyma* ab. *striata* Ksienschopolsky, 1911, *Trd. Obsc. izsl. Volnyi Zitomir* **8** : 37 (fig.). The markings on the under surface of the hind-

wings enlarged and arranged in a median fascia. An aberrational form. Preocc. by *d. striata* Skala but see *nigroguttata* Sovinsky.

stupenda *M. didyma* ab. *stupenda* Nitsche, 1926, *Verh. zool.-bot. Ges. Wien* **84–85** : 62. Loc. Dolomites. Almost entirely black upper surface. Below the markings are all much enlarged. Cf. *nigra* Balestre and *late-fasciata* Vorbt.

subalbida *M. didyma alpina* form n. *subalbida* Schultz, 1908, *Ent. Z.* **22** : 91. Loc. Wallis. Female aberration. The ground-colour much paler.

subalpina *M. didyma subalpina* Verity, 1919, *Ent. Rec.* **31** : 180. Loc. Cottian Alps. Smaller than *alpina*, the females not so dark, the wings longer. Possibly a late generation.

subpatycosana *M. didyma* race *subpatycosana* Verity, 1924, *Ent. Rec.* **34** : (Suppl.) : 38. Loc. Lucca (Camione). Exactly corresponds with *patycosana* Trti. but the ground-colour is paler and the females are not suffused. Probably a synonym of *patycosana*.

subrubida *M. didyma subrubida* Verity, 1919, *Ent. Rec.* **31** : 180. Loc. Berlin. Smaller and brighter than *rubida* Vrty. Doubtfully distinct from the typical form.

subseilemis *M. didyma subseilemis* Verity, 1929, *Ent. Rec.* **41** : 73. Loc. Mt. Aigoual—Cevennes. Intermediate between *seilemis* and *subalpina*. Also found at Barcellonette.

subtarlonia *M. didyma subtarlonia* Vrty, 1929, *Ent. Rec.* **41** : 74. Loc. Lake Maggiore (Mountains). A mountain form, like *tarlonia* but smaller.

subtuscrassipuncta *M. didyma* O. *subtus-crassipuncta* Reverdin, 1919, *Bull. Soc. Lép. Genève* **4** : Pl. 6. Loc. Var. The marginal spots enlarged on the under surface of the hind-wings.

superalpina *M. didyma superalpina* Verity, 1929, *Ent. Rec.* **41** : 66. Loc. Bormio—Liguria. Small with dark females. An extreme alpine form taken at 2000 m. Synonym of *alpina* Stgr. See also *rectealpina* Vrty.

supercaldaria *M. didyma* Esp. rassa *supercaldaria* Sagarra, 1926, *Butll. Inst. Catal. Hist. nat.* (2) **6** : 130. Small, with the black markings reduced, especially the median series of the hind-wings. Recalls *deserticola* Oberth. Loc. Montseny—Catalonia. Taken in July/Aug. A late generation.

tarlonia *M. didyma tarlonia* Fruhstorfer, 1917, *Arch. Naturg.* **82** (A) (2) : 8. Loc. Simplon—Crevola. A large *occidentalis* form with yellow females.

tenuisignata *M. didyma* ab. *tenuisignata* Skala, 1907, *Ent. Z. Guben* **20** : 310. Loc. Nikolsburg. An aberration. The ground-colour paler and all markings finer. Cf. *boulei* Ob.

turanica *M. didyma* O. var. *turanica* Stgr., 1886, *Stettin. ent. Ztg* **47** : 231. Loc. Margelan, Osch etc. A very large form with orange females. See p. 208. The name is preocc. by *M. turanica* Ersch. 1874. See *d. turkestanica* Shelj.

turkestanica *M. didyma turkestanica* Sheljuzhko, 1929, *Mitt. Münch. ent. Ges.* **19** : 354. Nom. n. pro *didyma turanica* Stgr. 1886 *nec M. turanica* Ersch. 1874. See p. 208.

variabilis *M. didyma variabilis* Belter, 1934, *Arb. morph. tax. Ent.* **1** : 108. Loc. Brussa—Asia Minor. The males rather dark for an oriental form. Female strongly powdered with greenish. See p. 206.

viridescens *M. didyma* forma *viridescens* Fruhstorfer, 1917, *Arch. Naturg.* **82** (A) (2) : 9. A name for the greenish type of female.

wullschlegeli *M. didyma* ab. *wullschlegeli* Oberthur, 1909, *Et. Lép. comp.* **3**, fig. 141–142–145. Aberrational form. The discal markings absent on the fore-wings.

ziegleri *M. didyma* ab. *ziegleri* Stichel, 1900, *Berlin. ent. Z.* **45** : 128. Loc. not cited. Aberrational form, with the pattern much distorted. The base of the fore-wings and most of the hind-wings black. The distal markings are vague.

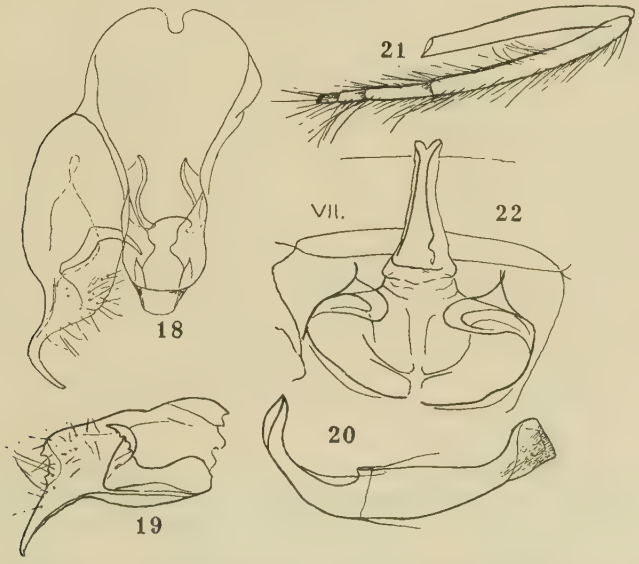
zinburgi *M. didyma* ab. *zinburgi* Skala, 1907, *Ent. Z. Guben* **20** : 311 (ref. to *Ent. Z.* **13**, fig. 2). Very abnormal aberrational form, the hind-wings with striate marks. Said to be equivalent to *ziegleri* Stichel.

2. *MELITAEA TRANSCAUCASICA* Turati. Plate 3 fig. 1 ♂; 7 ♀. Distribution Map 2.

Mel. didyma transcaucasica Turati, 1919 (1920), *Nat. Sicil.* **23** : 225. Loc. Nucha :—Transcaucasus.
Mel. didyma caucasi Verity, 1929, *Ent. Rec.* **41** : 43; 112.
Mel. trivia caucasi Verity, 1922, *Ent. Rec.* **34** : 13. Loc. Caucasus, Latpari Pass 2000 to 3000 m.
Mel. didyma ssp. *venosata* Niesiotowski, 1937, *Ann. Mus. zool. Polon.* **11** : 469. Loc. Caucasus.

Fore-wing ♂ 18–19 mm., ♀ 18–23 mm.

In this species of small or moderate size, the ground-colour of the male on the upper surface is vivid orange-brown. There is a complete series of black submarginal crescents on the



Figs. 18–22.—*Melitaea transcaucasica* Turati. 18. Male genitalia, dorsal view. Borjom, Transcaucasus; 19. Clasp, lateral view; 20. Penis, lateral view; 21. Male fore leg; 22. Female genitalia, dorsal view. Borjom.

fore-wing, particularly prominent in cellules 2 and 3. On the hind-wings the submarginal crescents are also regular and complete, while the development of the discal markings is variable. In the female heavily suffused *viridescens*-like forms are the rule, and the macular bands are well marked and regular. The hind-wings are usually orange anteriorly, but the posterior half is more or less clouded with dark scales, which are always present along the inner margin. The submarginal lunules are prominent as in the male. On the under

surface of the hind-wings the ground-colour in both sexes is distinctly lemon-yellow, and the black markings are fine and linear. The nervures are commonly outlined with black scales as they cross the narrow orange submarginal band, which is bordered distally by a continuous row of deeply excavated and often very prominent black submarginal crescents.

The male genitalia (fig. 18) are narrower than those of *didyma*. The tegumen in particular is smaller, but the saccus is wide and curiously rounded. The claspers (fig. 19) are relatively wide, with an indefinite spine which is sometimes almost absent. The penis (fig. 20) is less curved than in *didyma* and the proximal limb appears to be shorter. The male fore tarsus (fig. 21) is composed of three joints in four specimens examined. The female genitalia (fig. 22) closely resemble those of *didyma*.

Distribution. This insect occurs at alpine or subalpine elevations and seems to be restricted to the eastern Caucasus and Transcaucasus. I have two specimens labelled " Achal Tekke " but this is probably an error. If confirmed, this locality would be of great interest, as *didyma* also occurs there and I have not seen any specimens of this species from any other locality where *transcaucasica* flies. The former is certainly found in a large form at low levels in the north-western Caucasus, but as far as I know it is absent from the mountains farther south, where its place seems to be taken by *transcaucasica*. Unfortunately material from this region is limited, but the latter form is so unlike true *didyma* and so constant in its characters that I feel it can best be treated as a distinct species. The slight differences in the male genitalia and the fore tarsus confirm this view. I have seen no specimen of *transcaucasica* which might be confused with any other insect.

Localities :—Caucasus : Nucha (Turati); Tiflis (Brit. Mus.); Teberda, 2800 m., 26 July 1933; Latpari Pass, 2300 m. (Verity); Transcaucasus : Borjom, apparently common (Brit. Mus.); Achalzich (Brit. Mus.); (Transcaspia, Achal Tekke ?).

3. ***MELITAEA PERSEA*** Koll. Plate 4 fig. 6 ♂. Distribution Map 3.

M. persea Kollar, [1849] 1850, *Denkschr. Akad. Wiss Wien* **1** : 52. Loc. Shiraz—Persia.
M. didyma magnacasta Verity, 1929, *Ent. Rec.* **41** : 128. Loc. South Persia.
M. didyma araratica Verity, 1929, *Ent. Rec.* **41** : 113 (H.-S. 324–327). Loc. Mount Ararat, Asia Minor.
M. didyma sargon Hemming, 1932, *Trans. ent. Soc. Lond.* **80** : 272. Loc. Near Baghdad—Transjordan.
M. tauricus Belter, 1934, *Arb. morph. tax. Ent.* **1** : 109. Loc. Syria—Achyr Dagh.
Mel. trivia var. H.-S. 324–327.

Fore-wing ♂ 20 mm., ♀ 24–26 mm.

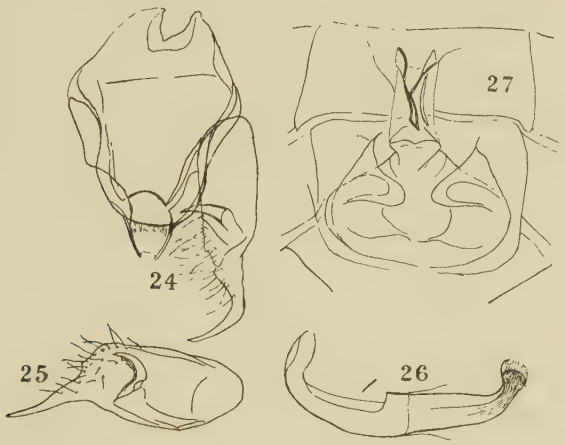
In the male on the upper surface the ground-colour is clear yellowish-orange. The usual black markings are greatly reduced. On the fore-wing the orbicular mark is very small, and the discal series is represented by the costal bar of four oval macules and a mark in cellule 1b. The submarginal series and the terminal dots are present, the latter sometimes enlarged and nearly free of the fine terminal black line. On the hind-wing the basal shade is not extensive, and the discal markings are absent. The submarginal crescents may be wanting also but these may be exaggerated, and the marginal dots are usually conspicuous. On the under surface of the hind-wing the submarginal orange fascia is broken into its component macules, each of which is typically bordered proximally by a black lunule. In the female the ground-colour is even paler, and the black markings more complete. In the summer-brood specimens of both sexes are smaller and paler, and the black markings are more scanty.

The male genitalia closely resemble those of *didyma*, but the whole structure is longer and narrower. The tuberculated area of the clasp (fig. 23) is less prominent, and slopes

smoothly into the posterior process, which is shorter and less acutely angled, and bordered below by a narrow dentate crest. The spine is small.

Figs. 23–23a.—23. *Melitaea persea persea* Kollar. Clasp, Dasht-arjan, near Shiraz. Lateral view; 23a. *Melitaea persea caucasica* Staudinger. Clasp, Elizabethpol. Lateral view.

In the north of Persia appears a smaller form of which I have seen many specimens, and for which I propose the name **Melitaea persea hafiz** form n. (Pl. 4 fig. 5 ♂). The measurements of the fore-wing are about 18 mm. and 20 mm. in the respective sexes. On the upper surface of the male the ground-colour is clear yellow and the black markings are more complete, especially at the base of the fore-wing in the discoidal cell. The terminal line of both wings is wider and fused with the terminal dots which do not appear so much enlarged. The females are often more or less clouded with grey. The usual distinctive pattern is developed on the under surface of the hind-wings in both sexes. The male



Figs. 24–27.—*Melitaea persea hafiz* Higgins. 24. Male genitalia, dorsal view. "North Persia"; 25. Clasp, lateral view; 26. Penis, lateral view. North Persia; 27. Female genitalia, dorsal view. "North Persia."

genitalia of this form are shown in fig. 24. The clasp (fig. 25) shows almost no spine, and no crest is obvious below the posterior process in two preparations. The penis (fig. 26) shows a sharply upturned distal extremity. These small differences between *persea* and *hafiz* may not prove constant when more specimens are available. The female genitalia examined in *hafiz* are very close to *didyma*, but in two preparations there are small differences which are probably constant. The organ (fig. 27) is rather longer antero-posteriorly, the auricles are more closely approximated and the bacillus is quite distinctly bifid for about half its length. The type is in the British Museum.

Distribution. The butterfly is known to inhabit different districts of one large area of south-western Asia extending from Syria to Baluchistan. The

presence of desert regions in the terrain will naturally tend to isolate colonies, and at least three local forms may be distinguished. In southern Persia appears the large typical *persea*, from which a series from Transjordan, described as *sargon* by Hemming, can scarcely be separated. Farther north in Luristan the black pattern of the males is more complete, and this form appears to run right through to Asia Minor, whence it has been named *araratica* by Verity and *tauricus* by Belter. Unfortunately no good series from northern Syria is available for comparison, but judging from Belter's description and from the beautiful figures given by Herrich-Schaeffer, the form is scarcely different from southern specimens. In the first brood the examples are large, and the long fore-wings mentioned by Belter are a feature of a series from Luristan in Mr. E. P. Wiltshire's collection. In the northern range of distribution the males often lack the black lunules along the proximal border of the orange submarginal macules on the under surface of the hind-wing, which are so conspicuous in typical *persea*, and occasional dark orange females are mentioned by Belter. The smaller and paler summer generation has been named *microtauricus* by Belter (*loc. cit.*). I have seen a few specimens of a very large and boldly marked form from the Caucasus and elsewhere, referable to Staudinger's *caucasica*, which is probably correctly placed here. A few specimens I have seen from the Lebanon have been small and sparsely spotted, and referable to a second or even a third brood. A female is figured on Plate 4 fig. 6. In the Achal Tekke region of Transcaspia the wing-pattern shows definite modification in the well-characterised *paphlagonia* Fruhst. described below. In the extreme east, in Baluchistan, the insect is known in the less modified form *dodgsoni* Gr.-Sm. At present adequate series of early and late broods from different localities are not available, and it is scarcely possible to give a confident grouping of the local forms. All those here included under *persea* are certainly very closely related, and probably they are best grouped as a single subspecies.

Determination. In the male this insect can be distinguished from *didyma* by the paler ground-colour, the somewhat scanty markings, the small orbicular mark of the fore-wing and the larger terminal dots along the outer margins. On the under surface the orange submarginal fascia of the hind-wing bordered proximally by black lunules is characteristic. The black lunules are always present in the females, and this should make determination easy. In the north-west of the distribution area the black lunules are sometimes absent from the males, especially in the later broods. In this case the orange fascia is usually formed of a series of distinct and separate macules. In the Lebanon confusion may occur with *montium*. This is a smaller insect, the ground-colour is more reddish and darker, and the outer marginal terminal line on the upper surface is wider. The specific characters are best marked in the female and the determination of the males may present difficulties.

Speaking of "*persea*" (i.e. *hafiz*) Christoph says (1873, *Hor. Soc. ent. Ross.* **10 :** 28) that the butterfly is not rare near Shahkuh, flying with *didyma*. He found upon *Scrophularia* a coffee brown Melitaeid larva with black marks on the sides, which produced a female *persea*. He concluded that the species must be distinct from *didyma* in spite of the close resemblance.

Note. Kollar's description of *persea* is too incomplete to permit a confident determination by this alone. For many years the name has been applied to the pale *didyma*-like insect described above, which appears to be widely distributed in Persia. I have lately been informed that the original type specimen of *persea* has been examined by Belter and found to be conspecific with his *tauricus*, with

which *persea* must be associated. On this authority I have decided to employ the name although the determination cannot be confirmed at present. If the identification should be incorrect, *dodgsoni* Gr.-Sm. 1887 will become the specific name for the unit.

Localities:—Persia: Dasht-Arjan (approx. 53° E. × 29·5° N.) near Shiraz, 3 ♂♂, 2 ♀♀, 6000 ft., 26 April 1919. These are referable to Kollar's *persea*, which came from the same district. Many specimens of the smaller form *hafiz* seen, mostly without full data. Many of these certainly came from northern Persia, some from Christoph's collection. I have also three old specimens of this form labelled "Askhabad". Luristan; a good series without full data collected by E. P. Wiltshire at 6000–7000 ft. dated 12 June 1938. The specimens are large and the black spots rather more complete than in the southern examples. Near the Syrian form. Transjordan: Baghdad. 6 ♂♂, 1 ♀ in Brit. Mus., the type and paratypes of *sargon* Hemming. I can detect no difference from *persea*. Syria: Bludan (Ante-Lebanon) June 1936. E. P. Wiltshire. Rayat, July 1935. Zawita, June 1935. "Summit of Cedar Mountain" Aug. 1897.

Melitaea persea caucasica Stgr.

Mel. didyma var. *caucasica* Staudinger, 1861, *Cat.* (Ed. 1): 8. Loc. Caucasus.
Mel. trivia var. H.-S. 588–590. Text Suppl.: 4. Loc. Elizabethpol.

Fore-wing ♂ 22 mm., ♀ 24–27 mm.

In the male the ground-colour on the upper surface is darker than usual in this species. On the fore-wings the black submarginal macules are exaggerated, particularly those in cellules 3 and 4, and the marginal internervular dots are enlarged and fused with the fine black marginal line. The hind-wings show a wide dark suffusion at the base, and black discal macules are present. The submarginal macules are conspicuous semilunules. On the under surface of the fore-wings the markings are not distinctive. On the hind-wing the ground-colour is distinctly yellowish and the markings bold. The basal orange fascia is broken up, the submarginal orange fascia is a series of discrete macules, each of which shows traces of the characteristic proximal border of black scales. In the female the ground-colour is bright orange on the upper surface, with the black pattern very even and complete.

The genitalia resemble those of *persea*. The clasp is figured (fig. 23a) to show the absence of a true spine. The dentate crest below the posterior process is well developed (1 preparation).

Distribution. Of this form I know only one male and three females. The male is from Elizabethpol, and this corresponds very closely with Herrich-Schaeffer's figs. 588–590. The female corresponding is slightly suffused and shows white costal macules near the apex of the fore-wing. The female figured (Plate 4 fig. 11) is from Marasch in northern Syria; there is no dark suffusion at the wing-bases and the discal spots are small. A third specimen labelled shortly "Caucasus" is almost identical but the discal spots are slightly larger. I have no doubt that this is the form depicted by Herrich-Schaeffer in figs. 588–590, and that it is distinct from *didyma*. The main features agree closely with *persea*, but the outlines at the cellular macules on the upper surface of the hind-wing are rather more oblique than usual. The material available is very scanty, but I have placed it provisionally with *persea*, of which it is the largest form known. The data of the specimen from Marasch are certainly accurate, and its appearance there is interesting, suggesting possibly a transition to the form *tauricus* Belter. A large and dark race of true *didyma* also occurs in the northern Caucasus (see *M. didyma graeca*, p. 204).

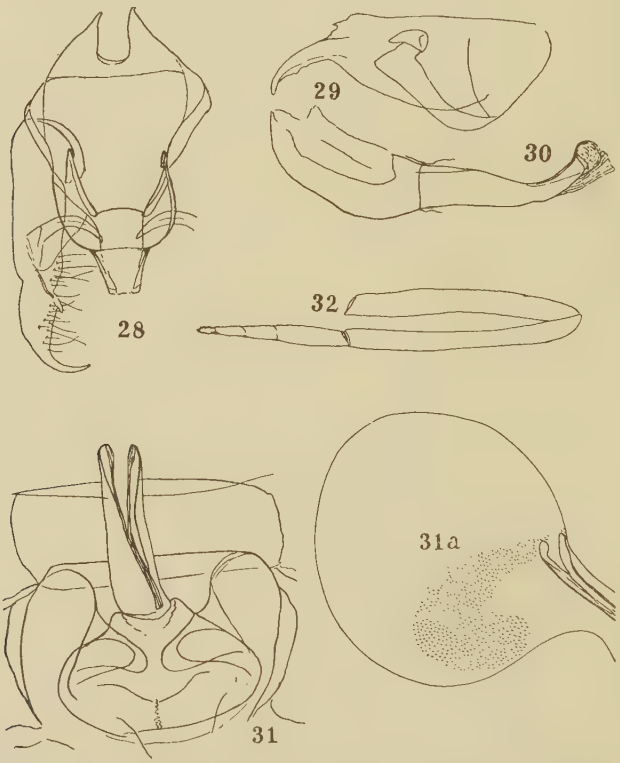
It is hoped to figure this form in a supplementary plate.

Melitaea persea dodgsoni Gr.-Smith. Plate 4 fig. 1 ♂, 7 ♀. Distribution Map 2.

Melitaea dodgsoni Grose-Smith, 1887, *Ann. Mag. nat. Hist.* (5) **20** : 130. Loc. Gwashki, Baluchistan, 8600 ft.

Fore-wing ♂ 18–21 mm., ♀ 21–23 mm.

On the upper surface in the male the black pattern is more complete than in typical *persea*, but the fore-wings are not lengthened as is often the case in Syrian examples. The characteristic black lunules are present in the orange submarginal fascia on the under



Figs. 28–32.—*Melitaea persea dodgsoni* Grose Smith. 28. Male genitalia, dorsal view. Urak, Baluchistan; 29. Clasp, lateral view. Mehtazai; 30. Penis, lateral view. Urak; 31. Female genitalia, dorsal view. Mehtazai, Baluchistan; 31a. Bursa copulatrix, enlarged; 32. Male fore leg, showing four tarsal joints.

surface of the hind-wings of all specimens seen. In the female the black markings are more pronounced and the ground-colour is often varied by a row of yellow macules on the fore-wing behind the median spots.

The male genitalia (fig. 28) scarcely differ from those of typical *persea*. The clasp (fig. 29) shows the dentate crest beneath the posterior process. The penis (fig. 30) in two preparations appears to be decidedly straighter than usual and the distal extremity is less sharply upturned. The female genitalia (fig. 31) resemble *persea*. A figure of the unruptured bursa copulatrix is given (fig. 31a) to show the spiniferous areas extending from the bifid bacillus.

The typical form described by Grose-Smith expands about 38–40 mm. In many districts, perhaps in a late brood, there occurs a much smaller form of about 34 mm., in which the black markings on the upper surface may be reduced. All intermediate sizes occur and no definite distinction can be made. There are probably two broods annually, and in its flight places the insect appears to be common.

Identification. This species has to be distinguished from *M. lutko* Evans with which it is often associated in Baluchistan. In the latter there is nearly always a series of yellowish macules behind the discal row of spots on the fore-wing. The first four discal spots are usually fused into a heavy bar. On the hind-wing the black basal suffusion is more extensive and fills the cell. On the under surface of the hind-wing the proximal orange fascia is narrow and broken up. The submarginal orange fascia is also narrow and the post-discal black marks are often distinctly V-shaped, pointing inwards. The insects can be separated with ease once the distinction has been grasped. The similarity in two species, which are certainly not very closely allied, is very remarkable.

Distribution. The known distribution is restricted at present to a few localities in Baluchistan and one in Afghanistan. The insect probably extends widely through Baluchistan, very likely to Persia.

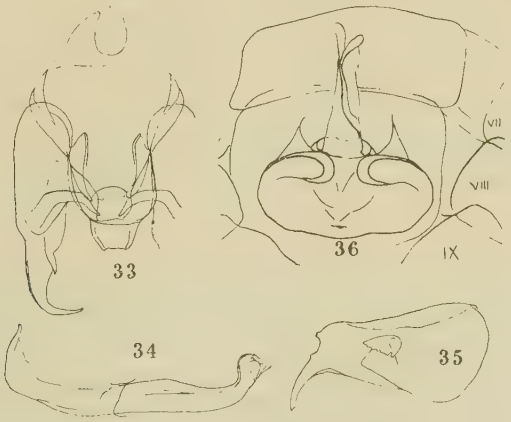
Localities :—Afghanistan : Logar Valley, June, July and August; Baluchistan : Chaman; Mehtarzai Pass, 7000 ft., 10 June 1931, Gwashki, 8600 ft. (type *dodgsoni*); Urak, 6 May 1929, small form; Khojak, 16 April 1929, small form.

Melitaea persea paphlagonia Fruhst. Plate 4 fig. 2 ♂.

M. didyma paphlagonia Fruhstorfer, 1917, *Arch. Naturg.* **82** (A) (2) : 10. Loc. Arwas—Transcaspia.

Fore-wing ♂ 20–21 mm., ♀ 20–23 mm.

In size this insect agrees with the larger specimens of *persea*, except that the females are smaller. On the upper surface the ground-colour is yellowish-buff. The markings are well



Figs. 33–36.—*Melitaea persea paphlagonia* Fruhstorfer. 33. Male genitalia, dorsal view. Arwas, Transcaspia; 34. Penis, lateral view. Arwas; 35. Clasp, lateral view. Arwas; 36. Female genitalia, dorsal view. Arwas.

developed. In particular the first four spots of the discal series are fused in many specimens to form a prominent costal bar. The submarginal spots are regular and complete. On the under surface the usual *persea* characters are present. On the fore-wing the four

costal spots of the discal series are again well developed, but in most specimens the other spots of the series are not indicated. In the female the ground-colour is sometimes paler. As a rule the yellow post-median macules can be seen on the fore-wing.

The male genitalia (fig. 33) show small differences from typical *persea*. The penis (fig. 34) is more sharply upturned distally, in the clasp (fig. 35) the shoulder of the tuberculated area is better marked, but the crest below the posterior process is less obvious. The female genitalia (fig. 36) show the usual features of *persea*. The male fore tarsus often shows four joints.

Identification. This form flies with true *didyma*, from which it can be distinguished easily by the paler colour of the upper surface and the large free marginal dots. On the under surface the characteristic formation of the orange submarginal fascia on the hind-wing should prevent confusion. The form is well defined. I have seen a good many specimens but they are without full data and appear to belong to the spring brood only. It seems to be a common insect in Transcaspia.

Localities :—Transcaspia : Arwas, 5 ♂♂ and 4 ♀♀ (L.G.H.); Tekke, several specimens without further data.

4. ***MELITAEA MONTIUM*** Belter. Plate 4 fig. 4 ♂, 9 ♀. Distribution Map 3, p. 183.

Mel. montium Belter, 1934, *Arb. morph. tax. Ent.* **1** : 107. Loc. "Syria." No further locality.

Fore-wing ♂ 17 mm., ♀ 18–20 mm.

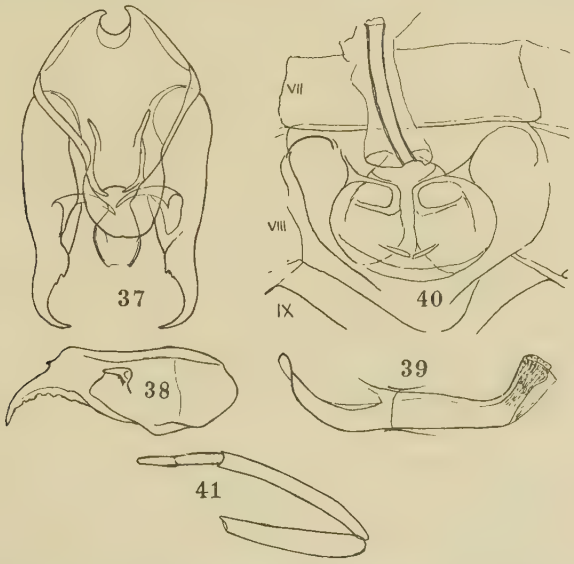
In this small form the ground-colour of the upper surface of the male is usually fiery orange-red. The markings are small and delicate and the resemblance to *didyma dalmatina* is very close. The reniform stigma in the cell of the fore-wing is represented by two rather widely separated transverse lines, below which in cellule 1b is an open U-shaped mark, more rarely a closed circle as in *didyma*. The black border along the margins of both wings is regular and often rather wide, including the terminal dots. On the under surface of the hind-wing the orange submarginal fascia shows segmentation as the yellow ground-colour spreads along the nervures. In some specimens but not in all the orange macules of this fascia show a proximal border of black lunules recalling *persea*. These black lunules are most commonly absent in male specimens of the later broods (Belter). They are always present in the females, in which sex the markings are rather more complete and the terminal dots along the outer wing-margins are particularly well marked.

In the male genitalia (fig. 37) the clasp shows one or two small spines. In the lateral view (fig. 38) there is a great resemblance to typical *persea*. The penis (fig. 39) shows the sharply upturned distal extremity met with in *hafiz*. These features appear constantly in four preparations.

No typical female specimen has been available for dissection. The preparation figured (fig. 40) is from an example taken on Cedar Mountain, referred rather doubtfully to *montium*, as the features are not like *persea*, to which species the example was at first referred. The male fore leg (fig. 41) is shorter than usual, and shows only two segments, while in most *persea* forms three segments are the rule.

Determination. This species has to be separated from *didyma* which flies in the Lebanon principally at lower levels. The latter is a larger insect with more pointed wings, and on the under surface the entire orange submarginal fascia of the hind-wings should make determination easy. Small forms of *persea* also occur in the Ante-Lebanon with *montium*, and almost certainly in the Lebanon also. All the specimens I have seen of the former insect have shown

the characteristic small discoidal circle and the scanty black markings of this species. On the under surface in both forms the orange submarginal fascia of the hind-wing may show the black proximal lunules, or these may be absent when the orange is broken by ground-colour on the nervures. The female of *montium* is a redder insect and the markings are more even than in *persea*, which is shown in pl. 4, fig. 10, slightly suffused with grey. The figures of the two butterflies are given together on the plate to prevent confusion. In the male the resemblance of *montium* and small *persea* is sometimes marked, and for a long time I considered that *montium* was probably a well-marked local form of *persea*. In Mr. E. P. Wiltshire's collection there are typical specimens of both species taken by him on the same day flying together at Bludan in the Ante-Lebanon. The male genitalia of the two forms seem to show identical characters. Possibly the female genitalia would provide better specific characters.



Figs. 37–41.—*Melitaea montium* Belter. 37. Male genitalia, dorsal view. Lebanon; 38. Clasp, lateral view; 39. Penis, lateral view; 40. Female genitalia, dorsal view. Lebanon; 41. Male fore tarsus.

The relationship of the two insects should be settled by Wiltshire's record, but I still feel that further confirmation is needed, and that *montium* may represent an unusually well-characterised modification of *persea*. Unfortunately material for study is by no means adequate. From the few specimens available it seems probable that *montium* appears slightly later than *persea*, and that male specimens of the former fly with females of the latter, which will be worn when the females are fresh. Ellison told me in a letter that *montium* occurs from 5000 ft. up to 7000 ft. or more. At the lower level it flies with *didyma*, which is met with in the Lebanon between 3000 and 5000 ft.

Distribution. As far as is known the insect is confined to the Lebanon and the Ante-Lebanon. This is such a small area that it is probable that the species will be found elsewhere in Syria as investigation proceeds.

Localities :—Syria : Lebanon and Ante-Lebanon. Bscharre June, 1850 m. upwards (Belter); Kanisah 10 May (Ellison); Cedar Mountain April/

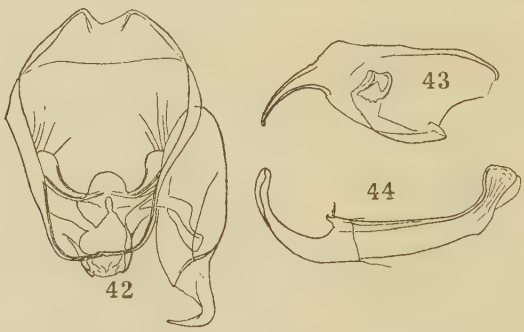
Sept., several specimens; Damascus 25 Aug. 5000 ft. Brit. Mus. (locality doubtful); Bludan 1 June 1936 (Wiltshire).

5. ***MELITAEA SAXATILIS*** Christ. Plate 8 fig. 1 ♂, 7 ♀. Distribution Map 3, p. 183.

Melitaea didyma var. *saxatilis* Christoph, 1873, *Hor. Soc. ent. Ross.* **10** : 28. Loc. North Persia. Mt. Shahkuh.
Melitaea fergana var. *hyrcana* Staudinger, 1882, *Berlin. ent. Z.* **26** : 169. Loc. North Persia, Mt. Shahkuh.

Fore-wing ♂ 18–19 mm., ♀ 20 mm.

On the upper surface of the male the ground-colour of the wings is orange-yellow in five specimens, but more reddish in the sixth. On the fore-wing the usual markings are present at the base, and the orbicular mark is large. The discal series is composed of rather small but regular spots, not confluent. The submarginal series is usually complete from the apex



Figs. 42–44.—*Melitaea saxatilis* Christoph. 42. Male genitalia, dorsal view. "Persia"; 43. Clasp, lateral view; 44. Penis, lateral view. "Persia."

to cellule 2, but the spots are very small. The black marginal border is wide and the marginal dots in cellules 2, 3 and 4 are conspicuous. On the hind-wing there is a wide basal suffusion extending half-way down the inner margin. There are some faint basal markings of which the most prominent is a fine elbowed black line opposite the end of the cell. On the under surface of the fore-wing the black markings are fine and the submarginal spots absent. On the hind-wing the ground-colour is pale yellow with a blackish suffusion at the base. The orange bands are wide and continuous. The usual series of black spots is present and exaggerated in two specimens across the disc. The female closely resembles the male.

The male genitalia (fig. 42) closely resemble those of *didyma*. The organ is rather wide, the penis notch in the ringwall closed by a strong fibrous band which is easily ruptured. Above this in one preparation it is possible to see two chitinous plates. The clasp (fig. 43) shows a few small tubercles but no trace of a true spine. The posterior process is very slender and tapers uniformly. The harpe shows a few small teeth, again recalling *didyma*. The penis (fig. 44) is somewhat abruptly upturned proximally and distally (2 preparations).

This insect has been united by Belter with *montium*, and he treats the latter as a subspecies. In my opinion the very different markings and the wide and strong genitalia point strongly to specific separation. There is no doubt that *persea* Koll., *montium* Belter, and *saxatilis* Christ. are all closely allied.

The butterfly was found by Christoph on Mount Shahkuh flying on stony slopes around the highest summits at 10,000 to 12,000 ft. in June. The male

and female paratypes are preserved among the short series in the British Museum. I have seen no specimens in any other collection. The specimens figured are paratypes.

Localities :—North Persia : Shahkuh ex coll. Christoph 3 ♂♂, 1 ♀, 14 June 1871, Brit. Mus. Persia : without further data, 1 ♂, 1 ♀ ex coll. Leech, Brit. Mus.

Melitaea saxatilis mod. ***sassanides*** Higgins. Plate 8 fig. 2 ♂, 8 ♀.

M. sassanides Higgins, 1935, *Entomologist* **68** : 112. Loc. Demavend.

In size this insect resembles the typical form. The fore-wings are short and wide in some specimens. On the upper surface the submarginal series on both wings is regular and distinct. The marginal internervular dots in cellules 3 and 4 of the fore-wing are not emphasised as much as in typical *saxatilis*. On the under surface the submarginal series of the fore-wing is clearly indicated. The ground-colour of the hind-wing is grey, with the usual series of black marks somewhat obscure. The basal orange fascia is much reduced and broken up into small macules. The submarginal orange fascia is narrow, often divided into a series of lunules each of which is bordered internally and externally by a fine black crescent. In one female the markings resemble the male, in the other the black markings are more complete (fig. 8).

The short and wide fore-wings, the regular and complete pattern and the distinctive markings on the under surface, produce a facies which differs a good deal from that of *saxatilis*.

I described this form as a distinct species, but it has lately been possible to examine the male genitalia, and clearly it is not distinct.

The form seems to be very rare, possibly restricted to Mount Demavend, and the only specimens I have seen are those in the British Museum.

Locality :—North Persia : Mount Demavend, 26 June 1894, ex coll. Gr.-Gr. (Brit. Mus.), 3 ♂♂, 2 ♀♀ (type and paratypes).

6. ***MELITAEA DESERTICOLA*** Ob. Plate 5 fig. 1 ♂. Distribution Map 2, p. 182.

Mel. didyma ab. *deserticola* Oberthur, 1876, *Ét. Ent.* **1** : 25. Loc. Algeria.

Fore-wing ♂ 19–21 mm., ♀ 23 mm.

This species resembles other desert forms in the group in its pale orange-buff ground-colour and in the absence of sexual dimorphism. On the upper surface it differs from *didyma* in the more even black spots, the larger marginal dots and the wider black basal suffusion. There is a delicate black pattern in the cell and on the disc of the hind-wings. On the under surface of the hind-wings the basal orange fascia is much broken up, and the discrete macules of the submarginal fascia are bordered proximally with black lunules. The female resembles the male, but is slightly larger.

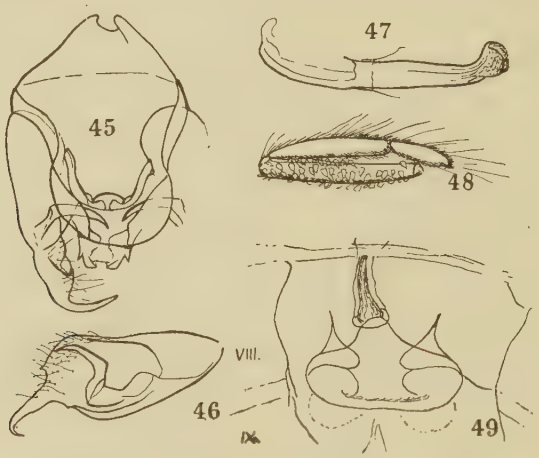
The male genitalia (fig. 45) differ from *didyma* in several details. They are short and remarkable for the complicated tegumen. The penis-groove is nearly or quite closed by the lingulae. The clasp (fig. 46) lacks a clearly formed spine and the harpe carries no teeth. The penis (fig. 47) is relatively straight. The female genitalia (fig. 49) are smaller than those of *didyma* in two specimens examined, and the cone is more prominent. The male fore leg (fig. 48) is greatly atrophied.

The larva of this insect is black and almost unicolorous.

There are preserved larvae in the British Museum. Seitz found them at Biskra, feeding upon high bushes (1908, *Grossschmet. Erde* (Pal.) **1** : 218).

Stauder reports larvae of *deserticola* not obviously different from those of *didyma*, at Biskra in the middle of May. He adds that *deserticola* was flying there at the same time in May and in the middle of June. A box of larvae were forgotten and were found alive later although without food for five or six weeks. This suggests that the species may aestivate as small larvae during the hottest months (1913, *Z. wiss. InsectenB.* **9** : 337). Possibly Stauder confused *deserticola* with the more extreme forms of *didyma mauretanica* which also occurs at Biskra.

Distribution. This interesting species has a wide distribution in the northern Sahara. It occurs also in Syria in a well-differentiated form described below. It is possible that the distribution is not now continuous, and the forms from these two localities seem sufficiently differentiated to rank as subspecies. The typical form is found in Morocco and in Algeria, always on the



Figs. 45–49.—*Melitaea deserticola* Oberthur. 45. Male genitalia, dorsal view. Algeria; 46. Clasp, lateral view; 47. Penis, lateral view; 48. Male fore tarsus; 49. Female genitalia, dorsal view. Biskra.

border of the desert. I have seen specimens from Tunis and the Libyan Desert. The available specimens have almost all been taken in the spring. I have only two examples in which the smaller size and reduced black markings suggest a second brood. Unfortunately these specimens are not dated.

Localities :—Morocco : Grand Atlas, Ourika, Amsmiz (Oberthur); Middle Atlas, no records. Algeria : Mecheria (end of March); Biskra (April, May); Laghouat (April, Oberthur); Aflou. Constantine : El-Outaya, April. Tunisian Sahara, Tamerzed (Oxford Mus.). Western Desert : 120 miles S. of Mersah Matruh, 16th July, 1 ♂. 120 miles W. of Mersah Matruh. Cairo, Wadi Hof Hilwan, 18th Mar. 1909.

Melitaea deserticola form. temp. ***harterti*** Roths. Plate 5 fig. 8, paratype.

Mel. didyma harterti Rothschild, 1913, *Novit. Zool.* **20** : 116. Loc. Central Sahara.

Fore-wing ♂ 18–20 mm., ♀ 20–22 mm.

The most striking character in this race is the absence of the black basal suffusion at the base of the hind-wings on the upper surface. The submarginal spots are of small size,

but the discal spots stand out clearly. The whole body is pale sandy yellow, and often the antennae also.

On the under surface the ground-colour of the hind-wings is yellowish instead of white, and the orange submarginal fascia is bordered internally by the post-discal spots. There is no trace of the black lunules which form the proximal border of each orange macule in typical *deserticola*.

The sexes are similar.

Distribution. This interesting desert modification was discovered by Dr. Hartert. It was first met with 200 miles south of Biskra, and occurred thence in the oases for another 200 miles to the south. It is connected with the typical form by intermediate specimens, and clearly represents a reaction to a desert climate.

Localities :—El Golea (Tring Mus.); Gardaia (Tring Mus.). Various other localities which cannot be identified on an ordinary map.

Melitaea deserticola macromaculata Belt. Plate 5 fig. 7 ♀; 16 fig. 6 ♀.

Mel. deserticola macromaculata Belter, 1934, *Arb. morph. tax. Ent.* **1** : 106. Loc. North Lebanon.

Fore-wing ♂ 18–20 mm., ♀ 22–24 mm.

In this form the fore-wings appear wide, the outer margin rather strongly convex. On the upper surface the ground-colour varies from orange to dull ochre yellow. On the fore-wings the discal spots are large, particularly those of the median series. On the hind-wings the black basal suffusion may be nearly or quite absent. No doubt it is most marked in the first-brood specimens. A few black marks can usually be seen at the apices of cells 2, 3 and 4. On the under surface the median spots of the fore-wings are very prominent. The marginal spots of the hind-wings are large and the crescentic proximal border of the submarginal fascia is usually wanting.

In specimens of the later broods the markings are smaller and the size is much reduced; the fore-wing is only 16 mm.

Distribution. This insect occurs in valleys near the sea-coast, in hot and moist places, up to 3000 ft., perhaps higher. At sea-level the first brood emerges at the end of March, the second about the end of June.

According to Belter, at least three broods of this butterfly occur on the Lebanon, where it flies from March to September. This appears to be the northern limit of its range. I have seen a few isolated specimens from other localities, from which it is possible to know something of its distribution. It occurs as far inland as Arabia, and to the south extends to Egypt, but seems very scarce. Quite possibly it will be found to cross the Libyan Desert to meet the western race.

The wide rounded wings and large black spots should prevent confusion with forms of *dodgsoni* which may occur with it. *P. didyma* only reaches the distribution area in the extreme north.

Localities:—Syria: Afka; Lebanon: Deir-el-Qamar, South Lebanon, 3000 ft. (Ellison), Beirout, many specimens; Ante-Lebanon, Brit. Mus.; North Lebanon, Ibrahim (Belter); Transjordan: Jabal-Suwada, 19 April 1923, Brit. Mus.; Wadi-Sir, 14 Aug. 1923, Brit. Mus.; Arabian Desert, 21 April 1903, no further data, Brit. Mus.; Egypt: Wadi-Hafa, Brit. Mus.; Suez, Brit. Mus.

7. ***MELITAEA ABYSSINICA*** Ob. Plate 5 fig. 6 ♂. Distribution Map 2, p. 182.

Mel. didyma abyssinica Oberth., 1909, *Ét. Lép. comp.* **3** : 243. Loc. Abyssinia.
Mel. abyssinica Oberthur, 1915, *loc. cit.* **10** : Plate X figs. 2303–2304.

Fore-wing ♂ 20 mm., ♀ 23 mm.

In this form the ground-colour on the upper surface is dull yellow-buff. The black markings are heavy, although the post-discal series is not complete. The marginal internervular dots are large and fused with the black marginal border. The fringes are less clearly interrupted with black and white chequers than is usually the case. On the under surface the black markings are conspicuously bold; in particular the marginal dots are large. On the hind-wing the basal orange fascia is somewhat broken, the submarginal fascia is simple, the macules not bordered internally with black crescents.

The genitalia of this form have not been examined.

This most interesting butterfly is known from only a single pair in the collection of the late Charles Oberthur. These specimens, which came from Boisduval's collection, are now in the British Museum. The characteristic pattern of *deserticola* may be seen on the upper surface of the hind-wing, but in other respects the species is well defined. In particular the very bold black spots on the under surface are most striking. The locality is noted simply as "Abyssinia". A slightly different form of this insect has lately been found in several localities in Arabia. This is described below as *scotti*.

Melitaea abyssinica scotti subsp. n. Plate 16 fig. 11 ♂, 12 ♀.

Fore-wing ♂ 19–20 mm., ♀ 22–23 mm.

In the male on the upper surface the ground-colour is brilliant tawny orange. At the base of the fore-wing the usual mark in cellule 1 opposite the reniform macule is absent or vestigial in all specimens seen. Compared with *didyma* the costal spots of the discal series are placed more obliquely, and the first macule in cellule 1 is also oblique. The post-discal series is only represented by one or two small dots on the costa, but the submarginal series of small round dots is complete. The fringes and a terminal line along the outer margin appear black, and the marginal dots are well developed. On the hind-wings the basal pattern is distinct, the discal spots absent in the specimen figured but present in two others. On the under surface the markings are boldly drawn and the black spots conspicuous. The enlarged marginal dots, the fine black marginal line and the dark fringes are more obvious. On the hind-wings the bold black markings are particularly striking. The basal orange fascia is a good deal broken up, usually of three distinct components. The submarginal orange fascia is not bordered internally with black lunules. In the female the ground-colour is paler.

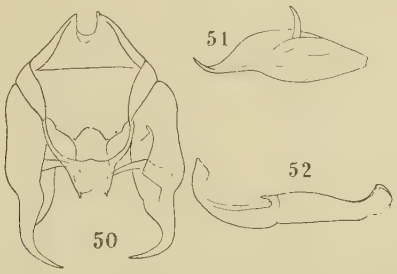
In the specimen figured the discoidal macule is very small. The oblique costal bar of the discal series on the fore-wing is very obvious. The black shading along the inner margin of the hind-wing is more extensive, and invades the discoidal mark in the cell. On the under surface the characters resemble the male.

This interesting insect was collected by Dr. Hugh Scott and Mr. E. B. Britton on the British Museum expedition to Arabia in the winter 1937/38. It is described from three males taken in the Western Aden Protectorate and two females from the Yemen. The type is in the British Museum. The specimens vary a good deal, but I think there can be no doubt that they all belong to the same species.

Localities :—Western Aden Protectorate : Jebel Jihaf, western face.

6600 ft., 6 Oct. 1937 (3 ♂♂); YEMEN: Summit of Jebel Kohl, 15 miles north of San'a, 9500 ft., 1 Feb. 1938 (2 ♀♀).

The genitalia of a single male have been examined. The ringwall (fig. 50) is not distinctive, the tegumen rather narrow, with a small scaphial element visible on each side posteriorly. The clasp (fig. 51) is simple, with no trace of a spine. The posterior process tapers gradually and is evenly curved from without inwards and from below upwards. It closely resembles the organ in *M. acreina* Stgr. The harpe is long and without teeth. The penis (fig. 52), slightly upturned at both ends, is not unlike that of several allied species.



FIGS. 50–52.—*Melitaea abyssinica scotti* Higgins. 50. Male genitalia, dorsal view. Yemen, S. Arabia; 51. Clasp, lateral view. Yemen; 52. Penis, lateral view. Yemen.

8. ***MELITAEA WILTSHIREI*** sp. n. Distribution Map 4, p. 185.

Fore-wing ♂ 18 mm.

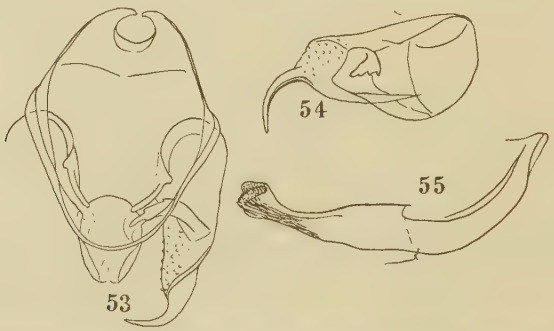
On the upper surface the ground-colour is bright orange-red. The apex of the fore-wing is blunt (obtuse). There is a short greyish black suffusion at the wing-base. The markings at the base and in the cell are very delicate, the orbicular mark small and narrow. The discal series is represented by a strong black costal mark extending to nervure 4 and angled on nervure 6. Below this are faint marks in cellules 1b, 2 and 3. The post-discal series is represented by a short and oblique costal macule. The submarginal series is entire, with deep lunules only in cellules 2 and 3. It is connected by fine black nervures with the rather wide terminal line which runs along the outer margin, with which the internervular dots are fused. The fringes are black with short white internervular interruptions. On the hind-wing the greyish basal suffusion is not extensive. The cellular marks are faintly visible. The discal series is represented by two macules and a mark on the costa, but these are absent in the second specimen. The submarginal series is complete, composed of deep lunules. The terminal line along the outer margin is rather wide. The fringes are white, with black interruptions. On the under surface of the fore-wings the ground-colour is orange, a paler buff at the tip. The basal field is unmarked, but the costal bar of the discal series is distinct, composed of four discrete macules. The submarginal series is weakly indicated, the terminal dots larger. The fringes are dark as on the upper surface. On the hind-wings the ground-colour is dull yellow. Four basal spots are orange, with two black dots above them. The basal orange fascia is much broken up, filled with orange and fused with a wide discal fascia broadly pale orange-buff. The submarginal fascia is wide, also filled with orange-buff, in which the usual black-ringed orange lunules are visible in cellules 1b to 5. The fringes are black proximally, forming a narrow black terminal line.

This species in known from two specimens in perfect condition collected by Mr. E. P. Wiltshire labelled " Alvand 8000 ft. 27 July, 1938 ". The type is

in coll. Wiltshire. The orange basal spots on the under surface of the hind-wing are a most unusual feature, which is found in no other member of the *didyma* group. This is clearly a relict form.

The genitalia in the male (fig. 53) are of the usual type. The clasp is distinctive. Seen from above, the toothed harpe is directed slightly forwards. There is no trace of a spine. In lateral view (fig. 54) the posterior process is very slender and sweeps downwards in a wide curve quite unlike any other species. The penis (fig. 55) is slightly curved, with a small olecranon. The shaft is unusually constricted in front of the ostium. The description is taken from a single male specimen.

It is hoped to figure this species in a supplementary plate.



Figs. 53–55.—*Melitaea wiltshirei* Higgins. 53. Male genitalia, dorsal view. Hamadan, Persia; 54. Clasp, lateral view; 55. Penis, lateral view.

9. ***MELITAEA DIDYMINA*** Stgr. Plate 2 fig. 2 ♂, 8 ♀. Distribution Map 2, p. 182.

Mel. didyma var. *didymina* Staudinger, 1895, *Deuts. ent. Z. Iris* **8** : 347. Loc. Changai Mountains, Uliassutai.

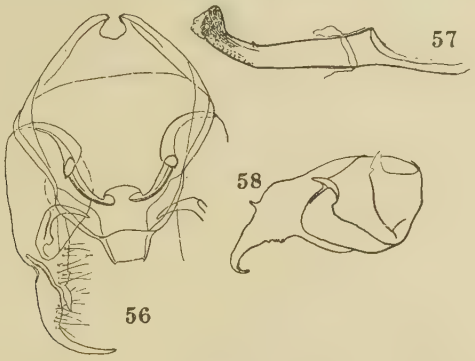
Fore-wing ♂ 17–18 mm., ♀ 18–20 mm.

On the upper surface this form closely resembles some examples of *didyma dalmatina* Stgr., from which it differs in the partial suppression of the submarginal spots, particularly on the hind-wing, and in the wider black marginal line. On the under surface the markings are very delicate and the basal orange fascia of the hind-wing is much broken up. By this character *didymina* can be easily distinguished from *didymoides* Evers., which occurs in the neighbouring Changai Mountains. The female is slightly larger than the male, and on the upper surface the black markings are more complete.

The male genitalia (fig. 56) closely resemble those of *didyma*. They are interesting in showing the marked development of the lingula, which is produced so far forwards on each side that the penis-groove is nearly closed. This character is also met with in *sutschana* Stgr. The resemblance is increased by the presence of a small spine on the dorsal surface of the penis (fig. 57). This is further from the extremity than is the case in *sutschana* and may well be absent in some specimens. The clasp (fig. 58) is short with a strong spine.

Distribution. It is probable that *didymina* is more nearly allied to *sutschana* than to any other member of the genus, and it is therefore a member of the eastern group of species. True *didyma* certainly occurs in Dzungaria and in some parts of Mongolia. I have seen specimens from the Changai Mountains, and it is probable that there is a close association with *didymina* in some localities. The available specimens are all from the Uliassutai, and nothing is

known of its further distribution. The specimens figured are the lectotypes chosen from the original series in the Staudinger collection. Fortunately in this case the locality label has been preserved.



Figs. 56–58.—*Melitaea didymina* Staudinger. 56. Male genitalia, dorsal view. Uliassutai; 57. Penis, lateral view. Uliassutai; 58. Clasp, lateral view. Uliassutai.

Melitaea didymina mod. ***perplexa*** mod. n. Plate 2 fig. 7 ♀.

Fore-wing 23 mm.

This insect is referred doubtfully to *didymina* Stgr. I have only one specimen, a female, which differs from the type in the constant development of all the markings on both wings.

On the fore-wings the discal series is prominent, the other markings are small and regular. The submarginal series is unusually sharply curved. On the under surface the basal orange fascia of the hind-wings is small and much broken up. The submarginal orange fascia is narrow and the lower macules are bordered proximally with black scales.

This well-differentiated form is labelled "Urumtchi, Thian Shan or." and the specimen is so far unique. The type is in my collection. It is to be hoped that further examples will soon be discovered, and that it will be possible to place it with greater accuracy.

10. *MELITAEA DIDYMOIDES* Eversm. Plate 5 fig. 3 ♂, 9 ♀. Distribution Map 4, p. 185.

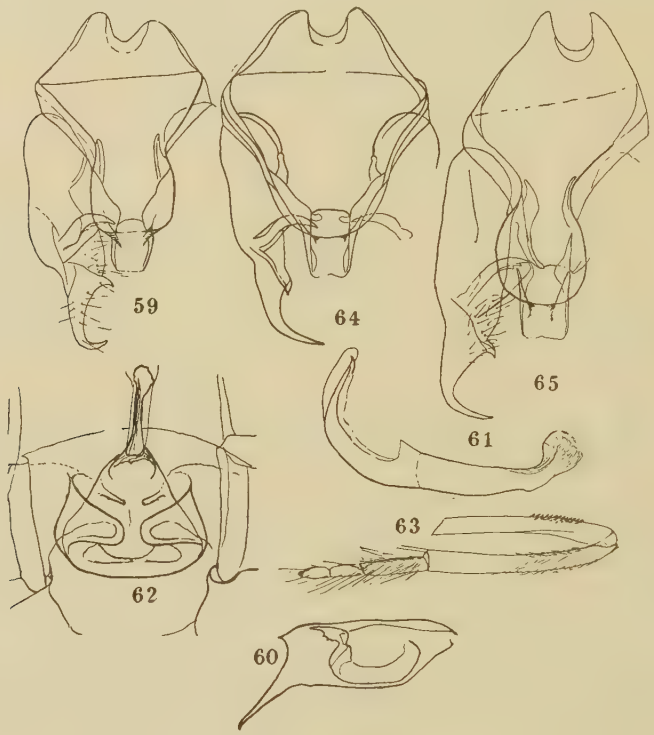
Mel. didymoides Eversmann, 1847, *Bull. Soc. Nat. Moscou* **20** (2) : 67, Pl. 1 figs. 3, 4. Loc. Kiachta (Kentei).

Fore-wing ♂ 16–18 mm., ♀ 16–20 mm.

This is a small and rather fragile insect with very pointed fore-wings. On the upper surface the broad, black marginal border is striking. In the male the usual markings are present at the base of the fore-wing and the median spots are well developed, with the four costal macules unevenly arranged. The post-median area is usually unmarked, although traces of the submarginal series may be present. There is a moderate amount of black basal suffusion on the hind-wings, which are otherwise unmarked, except for the black marginal border. On the under surface of the hind-wings the marginal dots are usually prominent. The submarginal orange fascia is wide and diffused inwardly, so that the black dots or crescents marking the proximal border of the individual macules often appear to be in the centre of the fascia. In the female the ground-colour of the wings is paler and

all the markings are much more complete. The wide black marginal border of the hind-wing is very obvious. The fore-wings are often much suffused with greenish-grey.

The male genitalia (fig. 59) closely resemble those of *didyma*. The tegumen is almost quadrilateral. The lingula projects on each side to overhang the penis-groove, and the scaphium provides a small flap which partially closes the canal of the hind-gut. These structures can be seen well if the genitalia are viewed from the front. The spine of the clasp (fig. 60) is very prominent, but there are few secondary tubercles. The harpe runs more forward than in *didyma* when viewed from above. The penis (fig. 61) is character-



Figs. 59–65.—*Melitaea didymoides* Eversm. 59. Male genitalia, dorsal view. Changai Mts.; 60. Clasp, lateral view. Pekin; 61. Penis, lateral view. Pekin; 62. Female genitalia, dorsal view. Pekin; 63. Male fore leg. Changai Mts.; 64. Male genitalia, Kansu (*latonia* Gr.); 65. Male genitalia, Pekin (*pekinensis* Seitz).

istic. The distal extremity is sharply upturned and the proximal limb is very long and curved into a semicircle. This feature is easily destroyed in extracting the organ, which is securely fixed in the penis-groove.

I have several preparations in which the lateral walls are constricted behind the tegumen. In these cases the genitalia do not appear otherwise different, and I think the appearance may be caused by pressure and flattening of the abdomen of the fresh insect. I have such specimens from the Changai Mountains and from Pekin.

In the female genitalia the cone is produced in a specimen from the Kentei Mountains and also in one from Pekin (fig. 62). In another example from the Richthofen Mountains this character is not so obvious. The scutum in all

three examples is more developed than is usual in this group. The fore tarsus (fig. 63) in the male is well developed, usually with three or four segments.

This species is widely distributed in eastern Siberia. It occurs in the mountains south of the Amur basin and lake Baical, and spreads from there to Corea and northern China. In most districts it is a mountain insect which flies at 6000–9000 ft., but it appears to fly on the plain in parts of China. The small typical form is met with in the mountainous regions in the western part of the distribution area. It seems to be common in the Kentei and Changai Mountains, where it is associated with *didyma latonigena* Eversm. It may occur also in the Sajan, and perhaps in the eastern Altai mountains, but I have seen no specimens from there.

Localities :—Kentei Mountains (no further data); Changai Mountains (no further data).

Melitaea didymoides mod. ***latonia*** Gr.-Gr. Plate 5 figs. 4 ♂; 10 ♀.

Mel. didyma var. *latonia* Grum-Grshmailo, 1891, *Hor. Soc. ent. Ross.* **25** : 455. Loc. Chuan-Che (Hoang-Ho).

Mel. didyma mandchurica Seitz, 1908, *Grossschm. Erde* **1** : 219. Loc. " Manchuria " *nec mandchurica* Fixsen 1887.

Mel. didyma eupatides Fruhstorfer, 1916, *Arch. Naturg.* **82** (A) (2) : 11. Loc. Central and East Kansu.

Mel. didyma ssp. *seitzi* Matsumura, 1929, *Ill. Comm. Ins. Japan* **1** : 15, nom. n. pro *mandchurica* Seitz 1908 *nec M. athalia mandchurica* Fixsen 1887.

Exp. alar. 42–50 mm.

This insect is slightly larger than typical *didymoides* and the wings are more ample. On the upper surface the ground-colour is usually slightly darker. In the male on the fore-wings the central spots of the median series are often indistinct or absent. The submarginal spots of the fore-wing and traces of the median series of the hind-wing are present in about 50% of specimens. On the under surface the orange submarginal fascia of the hind-wing is frequently narrow and interrupted at the nervures. In typical *didymoides* it is usually wider and continuous, and the marginal dots are more prominent.

In the female the wings are broader. The greenish suffusion is less marked and on the upper surface of the fore-wing the costal macules of the median series form a prominent bar.

The male genitalia are figured (fig. 64) and resemble those of *didymoides*.

The original description of this insect is short but I think the identity of *latonia* is clear. The characters emphasised by Grum—the narrow pointed fore-wings and the narrow interrupted orange fascia on the under surface of the hind-wings—do not agree with any other form known from the Amdo. Fortunately there are preserved in the British Museum eight specimens from Grum's collection which still bear his labels with the locality " Moudjik, Hoang-Ho ". These specimens are almost certainly paratypes and I feel the application of the name *latonia* is quite secure.

I have three males and one female from the Min-Shan in south Kansu which are remarkable in showing the characters of a mountain race analogous to *didyma* mod. *meridionalis*. The upper surface of the males is dark orange-brown, the black markings all accentuated. The single female is very heavily suffused with greenish-black and resembles the darkest *didyma* from the Alps of Europe. I feel sure that this is a climatic modification and do not consider that a special name is required. The insect is figured on Plate 5 fig. 5 ♂, 11 ♀.

At present *latonia* is known only from Kansu and Amdo, but it probably extends north and east and passes gradually into *didymoides* and *pekinensis*. The form is really not well differentiated but it is of interest as it occurs in and

near the Amdo, and must therefore come into close relation with *didyma* which does not occur elsewhere within the range of the species.

Localities :— Amdo, Moudjik, Hoang-Ho valley, 4–21 July 1890, ex coll. Gr.-Gr. (Brit. Mus.); China: Central and East Kansu (Fruhstorfer); North Kansu, Liangchow; Richthofen Mts., July, 3000 m. (L.G.H.); South Kansu, Min-Shan, 3000 m. (L.G.H.); Kalgan, North China (Tring); " Mandchuria " (Seitz).

P. didymoides mod. ***pekinensis*** Seitz. Plate 5 fig. 2 ♀.

Mel. didyma pekinensis Seitz, 1906, *Grossschm. Erde* **1** : 219. Loc. Pechili (North China).

Exp. alar. 42–58 mm.

This is altogether a larger and more robust insect than *didymoides*. The size is very variable; some specimens are among the largest Melitaeid butterflies. On the upper surface the ground-colour of the wings is clear orange-yellow. The markings of the male are relatively complete, the submarginal series is nearly always present on the fore-wings and often also on the hind-wings, which also show the discal spots in most specimens. On the under surface of the hind-wings the submarginal fascia is often wide and solid while the marginal spots are often very large.

The female resembles the male. Sexual dimorphism is exceptional and is never strongly developed, but female specimens attain the largest size.

The genitalia resemble those of *didymoides*. The male organ is figured (fig. 65).

This is a lowland form and in the absence of dark suffusion the female follows the general rule. It is widely distributed in north-eastern China and probably extends as far south as Shanghai but I have seen no specimens from there. The northern limit of its range is indefinite, and I can find no record to suggest the extension of *pekinensis* to the valley of the Amur or Ussuri, where it would come into relation with *sutschana*.

Localities :—China: Pekin (very large), many specimens. Tientsin, June 1933. Corea: Shahtung (L.G.H.).

11. ***MELITAEA ALA*** Stgr. Plate 2 fig. 4 ♂; 10 ♀. Distribution Map 3, p. 183.

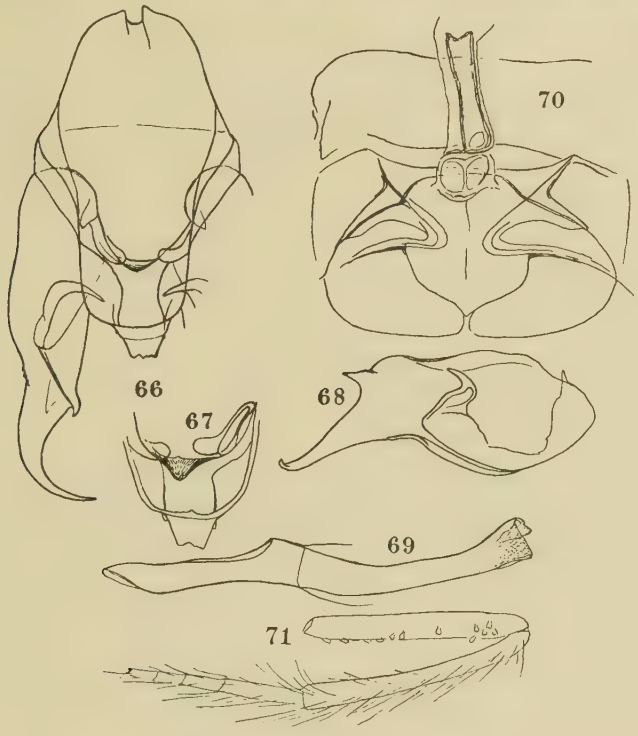
M. didyma var. *ala* Staudinger, 1881, *Stettin. ent. Ztg* **42** : 288. Loc. Lepsa; Ala-tau.

Fore-wing ♂ 21–22 mm., ♀ 21–24 mm.

This is an insect of medium size. In the male the ground-colour of the upper surface is bright orange. The usual markings at the base of the fore-wing and the discal series are regular and distinct. The post-discal series is represented by a few small spots near the costa. The submarginal series is complete, formed of regular crescents, sometimes continuous. Those in cellules 2 and 3 are larger than the others but the crescent in cellule 2 is not enlarged into a conspicuous spot as it is in nearly all specimens of *didyma*. Towards the outer margin the veins are distinctly outlined with black scales. There is a wide black marginal border to both wings, in which the large internervular spots are plainly visible. On the hind-wing the most striking feature is the wide, black basal suffusion which extends into cellule 1c to terminate near the anal angle in a rounded black spot. This most distinctive character is present in nearly all specimens. The discal series may be present but more often these markings are obscure or absent. The submarginal lunules are more or less developed adjoining the marginal border. On the under surface of the fore-wings the submarginal series is almost obsolete and the black marginal border is absent. On the hind-wing the nervures are more or less indicated by black scales, particularly towards the outer margin and across the orange submarginal fascia. The crescents which form the proximal edge of this fascia are definitely concave inwards. There is a small orange

macule in cellule 1b near the base of the wing. The females on the upper surface are always heavily suffused with greenish-grey, and the ground-colour may be visible only on the anterior half of the hind-wing. The marginal internervular dots are often much enlarged. On the under surface of the hind-wing the basal and submarginal orange fasciae are often narrow.

The *genitalia* of the male (fig. 66) are of large size and very long. The ringwall is produced into a blunt cone. In fig. 67 this structure is especially drawn from another specimen from the Amdo. This character appears again much accentuated in the two following



FIGS. 66–71.—*Melitaea ala* Staudinger. 66. Male genitalia, dorsal view. "Naryn"; 67. Posterior extremity of the ringwall, viewed from behind; 68. Clasp, lateral view; 69. Penis, lateral view; 70. Female genitalia, dorsal view. "Turkestan"; 71. Male fore leg.

species: *chitralensis* and *pseudoala*. The lingulae are wide and prominent. The clasp (fig. 68) is not distinctive. There is a well-developed spine and the harpe is without teeth in all specimens examined. The penis (fig. 69) is slender, slightly curved, and longer than in any other member of the group. The female genitalia (fig. 70) are very much like those of *didyma* and I can find no distinctive character.

The male fore tarsus is usually composed of four joints (fig. 71).

The specific rank of this insect was pointed out by Suschkin as long ago as 1913 (*Z. wiss. InsectenB.* **9** : 169). I have seen a good series from the district of Naryn, but in the main the insect is not well represented in English collections. As far as the available material goes, it suggests that *ala* occurs throughout the Thian-Shan. In the west it extends to the Alexander Mountains and other

ranges north of Ferghana, in the north it reaches the Dzungarian Ala-Tau, and in the east to the Amdo. The typical form is confined to the northern and eastern districts of its range. I have seen only four specimens from the Dzungarian Ala-Tau, part of the original series in the Staudinger Collection, of which I have figured the pair designated lectotypes. In addition I have several examples from the northern Thian-Shan (Pl. 6 figs. 5, 11) and from the Amdo which agree fairly well with the typical race. None of these is quite the same as Staudinger's original specimens from the Ala-Tau, and as it has not been possible to examine the genitalia of this form, its correct status must remain a little doubtful.

Distribution, etc. There is no doubt that *ala* is essentially a mountain insect which flies at elevations of 6000–10,000 ft. according to the locality, probably in subalpine regions. Unfortunately among a large number of specimens from all localities I have found the elevation noted in very few. A review of the geographical variation of *ala* was published by Sheljuzhko in 1929 (*Mitth. Münch. ent. Ges.* **19** : 362). He includes *latonia* Gr.-Gr. but this is a form of *didymoides*. The insect referred to as *kotshubeji* is perhaps unknown to me in nature. It is possibly referable to *chitralensis* Moore.

Localities :—Dzungarian Ala-Tau, Lepsa (Staudinger); Thian-Shan, no further data, many specimens; Amdo, ex coll. Groum-Gr., no further data (L.G.H.).

Melitaea ala bicolor Seitz. Plate 6 fig. 6 ♂, 12 ♀.

Mel. didyma ab. *bicolor* Seitz, 1907, *Grossschm. Erde* **1** : 219. Loc. Karagatai Mts. (? Karagai-tau).

Exp. alar. 40–48 mm.

In this form the black markings on the upper surface of the male are reduced. A pale macule is frequently present on the fore-wing near the apex. On the hind-wing the black basal suffusion is well marked but the discal and submarginal markings are reduced to a minimum or are altogether absent. On the under surface of the hind-wings the markings are variable and often somewhat irregular. The orange submarginal fascia is frequently broken into macules, and the lunules which form its proximal border are disconnected and uneven. The nervures are not obviously outlined with black scales.

In the female the difference from the typical form is less obvious. On the upper surface the grey suffusion is rather less extensive, and the markings are not so heavy. Exceptionally the hind-wings are almost entirely orange as in the male.

The genitalia resemble those of the typical form.

This is the most widely distributed form of the species, and occurs from the Alexander chain to the Thian-Shan and Alai Mountains. Its occurrence in the north so near the habitat of the typical form suggests at least a subspecific rank for the two races, which are well differentiated. Although there is the usual individual variation in *bicolor*, the form is surprisingly constant throughout its distribution.

The name was introduced for the female variant with the hind-wings almost entirely red, but it has been used already for the subspecies by Sheljuzhko and may be retained conveniently with this meaning.

Localities : Western Thian-Shan; Semirechgensee Prov., Fort Naryn, many specimens ex coll. Oberthur; Terskei Ala-tau; Issyk-kul (Brit. Mus.); Karagai-tau (Kara-tau) Mountains, Southern Issyk-kul, July (L.G.H.); Alexander Mountains, Aulie Ata (L.G.H.); Kok-su Pass, Tekkes, 6 June, 5000 ft. (L.G.H) ; Tekkes, Karagaitash, 25 July, 9500 ft. (L.G.H.); also a large number of specimens labelled " Ferghana ", " Turkestan ", " Central Asia ", etc. with no useful data.

The following special forms have been described :—

immodulata *M. ala* ab. ♀ *immodulata* Sheljuzhko, 1928, *Mitth. Münch. ent. Ges.* **18** : 366. Loc. Dzharkent, Semiretshje and Naryn. A female aberrational form, in which the fore- and hind-wings have both the same yellowish-red colour.

latemarginata *M. ala* ab. ♂ *latemarginata* Sheljuzhko, 1928, *Mitth. Münch. ent. Ges.* **18** : 366 (fig.). An aberrational form described from a single male. The pattern is distorted, the black macules radially extended.

12. ***MELITAEA PSEUDOALA*** Shelj. Plate 4 fig. 12 ♂; Pl. 16 fig. 4 ♀. Map 2, p. 182.

M. didyma turkestanica ab. ♀ *pseudoala* Sheljuzhko, 1928, *Mitth. Münch. ent. Ges.* **18** : 355. Loc. " Tashkent "—Kamtshi.
M. didyma turkestanica ab. ♀ *alboocellata* Sheljuzhko, *loc. cit.*
M. ala ninae (ssp. n.) Sheljuzhko, 1935, *Mitth. Münch. ent. Ges.* **25** : 28 (fig.). Loc. Tshimgan—West Tian-Shan.
M. rosea Higgins, 1938, *Entomologist* **71** : 34. Loc. Aulie Ata—Kasakstan.

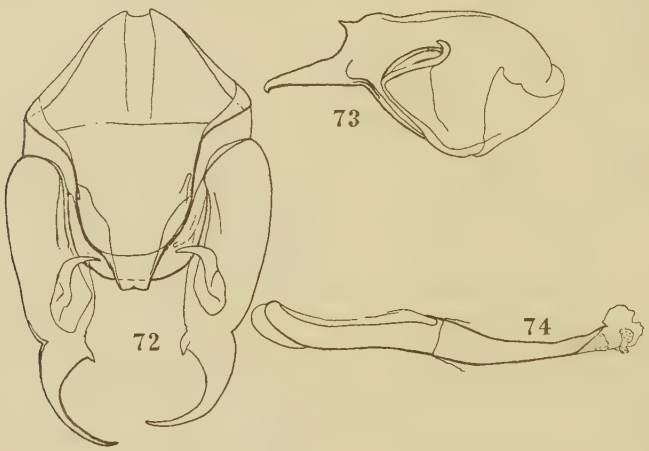
Fore-wing ♂ 20–23 mm.; ♀ 22–25 mm.

In the male on the upper surface the ground-colour is brilliant orange-red with a distinct rosy tinge. The markings of the fore-wing resemble those of *didyma*. The post-discal area is unmarked. In two specimens the submarginal series is complete and the spots show little tendency to form the usual lunules fused with the black wing-margin. In the third specimen the three lowest spots are obsolete. On the hind-wing there is an extensive black basal suffusion which terminates in a large round spot in cellule 1c as in *ala*. There are indications of discal markings but these are quite indefinite in all specimens with the exception of a small spot on the costal margin. The black marginal border is heavy, and its width is increased by the large internervular marginal dots which are fused with it. On the under surface of the fore-wing the markings are not distinctive; the submarginal series is nearly complete. On the hind-wing the orange submarginal fascia is broken into macules in two specimens. In the third it is entire, and in none is there any trace of the black scales which are present along the proximal border of the fascia in *enarea*. In the female the ground-colour of the upper surface is orange-red. On the fore-wing the markings are complete, including indications of the post-discal series. There is a slight amount of suffusion principally along the inner margin and the nervures. The posterior half of the fore-wing is decidedly more reddish than the base. The hind-wing is bright orange-red with the usual black suffusion extending from the base along cellule 1c. The heavy black marginal border composed of the marginal line and the internervular dots resembles that of *ala*. The disc is quite unmarked. On the under surface the markings are similar to those of the male. The ground-colour of the hind-wing is rather paler and the orange submarginal fascia is divided into macules by the yellow nervures. The six specimens from which this description is made are very uniform.

The male genitalia (fig. 72) are large but less elongated than those of *ala*. In the horizontal position the harpe is distal to and uncovered by the tegumen, a most unusual character. The ringwall behind the penis-groove is expanded and produced distally as a wide bulging shelf which is quite characteristic. The lingulae are less obvious than in *ala*. The clasp (fig. 73) is wide and the harpe is without teeth. The penis (fig. 74) is slender and slightly curved but not of unusual length. All these characters are constant in two specimens examined. The female genitalia have not been examined.

Distribution. The original specimen of *pseudoala* was taken in the Syr Darya near Tashkent at a place called Kamtshi. I cannot identify this on any available map. In this specimen, a female, the under surface is said to resemble

didyma, but on the upper surface there is an approach to *ala*, as the fore-wings are heavily suffused with grey, while the hind-wings are red-brown. This is extremely uncommon in Asiatic *didyma*. I have never seen such a specimen, and Sheljuzhko remarks that it is the only one in his collection. There is little doubt that the insect is wrongly placed with *didyma*, and although the description is short, I feel confident in referring it to *ninae* and *rosea*, over which the name has seven years precedence. The name *alboocellata* is based upon the same female specimen, and refers to white pupils in the orange submarginal macules on the under surface of the hind-wing. This means that the same specimen stands as the type of both names, of which *pseudoala* comes first on the page. Other specimens of this insect were collected in the same district by Sheljuzhko in 1934 and fully described and figured as *ninae*. My own series



Figs. 72–74.—*Melitaea pseudoala* Sheljuzhko. 72. Male genitalia, dorsal view. Kasakstan; 73. Clasp, lateral view; 74. Penis, lateral view. Eversible membrane protruded.

from the Talas Ala-Tau were probably found slightly more to the east. As far as is known the species is restricted to the mountains to the north and east of Tashkent.

Localities :—Kamtshi—Tashkent : no further data (Sheljuzhko); Tshimgan—Western Thian-Shan, 6 June–8 Aug. 1934, from 1500 to 2500 m. flying with *didyma* (*ninae*); Talas Ala-Tau—Aulie Ata, Kasakstan, 2500 m., July (*rosea*).

The following forms have been described by Sheljuzhko (*loc. cit.* 1935) :—

elongatoconfluens A female in which the black discal stripes and macules of the fore-wings are fused into a large blotch.

immodulata Female specimens in which the fore-wings and the hind-wings both show the same reddish colour. A form first described in *ala* (cf. *ala immodulata*).

magnifica Female form in which the fore-wings are heavily clouded with grey and violet scales.

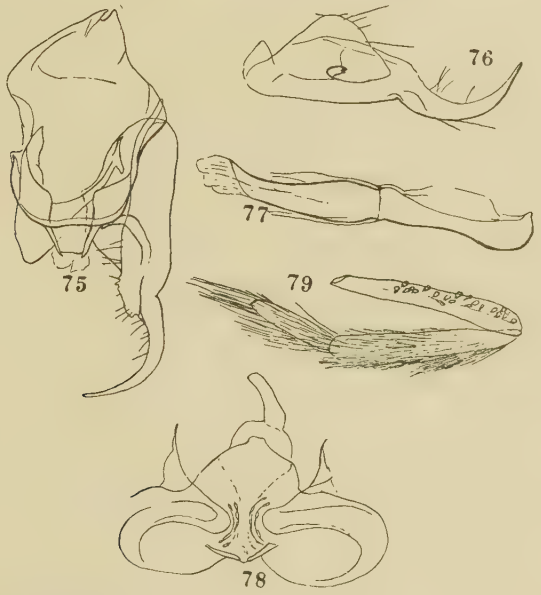
oblongomaculata Male specimens in which the discal black macules are extended into stripes (cf. *didyma oblongomaculata* Skala).

13. ***MELITAEA CHITRALENSIS*** Moore. Plate 6 fig. 3 ♂, 9 ♀. Map 2, p. 182.

Mel. chitralensis Moore, 1901, *Lep. Indica* **5** : 9. Loc. Chitral.
Mel. didyma chitralipluvia Verity, 1929, *Ent. Rec.* **41** : 43. Loc. Chitral.

Exp. alar. 45–52 mm.

In the male sex of this fine butterfly the upper surface is deep orange-red. On the fore-wings the discal series is heavily marked. The post-discal area may show two or three small macules near the costa. The large and regular submarginal lunules fuse with the black marginal border to form a striking series of crescents. On the hind-wings the basal markings are somewhat obscure. The discal series is usually complete, composed of large, prominent spots. In the specimen figured the series is relatively weakly developed. The submarginal crescents are complete and regular, continuing the series of the fore-wing.



Figs. 75–79.—75. Male genitalia, dorsal view. Chitral; 76. Clasp, lateral view, somewhat distorted. Chitral; 77. Penis, lateral view, eversible membrane protruded; 78. Female genitalia, dorsal view. Chitral; 79. Male fore leg. Chitral.

On the under surface the markings are fine and regular but not very distinctive. A small orange macule is usually present in cellule 1b near the base.

The female is a beautiful insect. On the upper surface of the fore-wings the yellow or orange ground-colour is partly obscured by the heavy markings and dark suffusion. On the hind-wings the orange anterior half contrasts strongly with the dark suffusion along the inner margin. As a rule the discal spots are well developed.

On the under surface the orange submarginal fascia of the hind-wing is bordered proximally by a series of black lines or lunules which are rarely altogether absent.

The male genitalia (fig. 75) are distinct. There is an extraordinary development of the ringwall (IX sternite) which is produced posteriorly as a tongue-shaped process and extends to the apex of the conical tegumen. The clasp is relatively wide with a strong spine. That illustrated in fig. 76 was distorted during disarticulation. The harpe is slender and is without obvious teeth in three specimens examined. The penis (fig. 77) is slightly curved.

The shaft is rather abruptly dilated behind the suspensory ligament, and a small spine is present on the dorsal surface near the apex.

The female genitalia (fig. 78) are relatively small. The cone is wide, the auricles long and narrow. The whole structure looks rather compressed antero-posteriorly.

The male fore-leg (fig. 79) is strong and very hairy. The tarsus is much atrophied, comprising but a single joint. This structure of the leg appears to be constant in this species.

This is a well-differentiated species. It is found at altitudes of 6000 to 10,000 ft., and is often associated with *P. didyma mixta* Evans but the bold markings of *chitralensis* should prevent any confusion. The known distribution of the typical form is confined to Chitral. With this I have united as a subspecies *P. enarea* Fruhst. described below. In the latter insect the large discal spots on the hind-wing are not developed and there are slight differences in the genitalia of the male. There is, however, the strongest resemblance to *chitralensis* in both sexes. The distribution areas of the two forms are contiguous and imperfectly known and I think it probable that further material will show that intermediate forms occur in the South-Western Pamirs.

Localities :—Chitral, 10,000 ft., 9 Oct. 1910 (L.G.H.); Chitral, several specimens, Brit. Mus.; Chitral, over 6000 ft., Evans (1932, *Indian Butt.* Ed. 2); Chitral, Shishi Kuh Valley, July/Aug., 9000–14,000 ft., L.G.H.

Melitaea chitralensis mod. ***kotshubeji*** Shelj. Plate 6 fig. 4 ♂, 10 ♀.

Mel. ala kotshubeji Sheljuzhko, 1929, *Mitth. Münch. ent. Ges.* **19** : 364. Loc. Tuptshek, Pamirs.

In the male the ground-colour of the upper surface rather dark orange-brown. The black markings are somewhat irregular, the cellular marks on the fore-wing very wide. The black submarginal crescents are complete in both specimens. On the hind-wings the discal series is not prominent. On the under surface the black markings are again reduced, and the orange fasciae of the hind-wing are wide and entire. The well-developed black submarginal crescents are deeply excavated. In the female the fore-wings are heavily suffused, except the cellular marks which show the orange ground-colour. Other markings are more complete than in the male. The black margin of the hind-wings is wide and the internervular dots are not developed.

The genitalia of the specimen figured appear indistinguishable from *chitralensis*. This form is rather less heavily marked than the type, and transitional to *enarea* Fruhst.

In the British Museum there are two pairs from " Samarcand " which are referable to this form.

Melitaea chitralensis enarea Fruhst. Plate 6 fig. 2 ♂.

Mel. didyma enarea Fruhstorfer, 1916, *Arch. Naturg.* **82** (A) 2 : 11. Loc. Pamirs, Garm. (*recte* Peter the Great Mts.).
Mel. didyma shugnana Sheljuzhko, 1929, *Mitth. Münch. ent. Ges.* **19** : 355. Loc. Pamirs, Chorog.
Mel. didyma ishkashima Sheljuzhko, 1929, *loc. cit.* **19** : 359. Loc. Ishkashim, South-West Pamirs.

Exp. alar. 44–52 mm.

The male sex of this subspecies closely resembles *didyma turkestanica*. On the upper surface the very regular and complete development of the submarginal lunules of both wings presents a striking feature. The chief difference from typical *chitralensis* lies in the absence of the discal macules of the hind-wing, of which as a rule the only representative is a dark macule in cellule 1c near the anal angle.

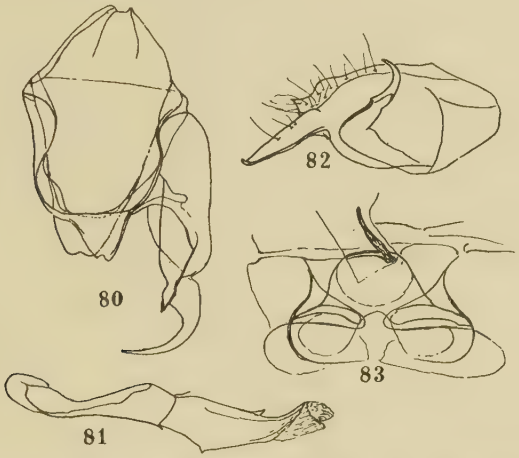
On the under surface there is usually a faint black proximal border to the lower components of the narrow orange submarginal band of the hind-wing.

In the female on the upper surface the relative absence of the discal markings of the hind-wing produces a sharp contrast between the clear orange anterior field and the dark inner margin.

The male genitalia (fig. 80) differ from those of *chitralensis* in two small details in the three specimens examined. The posterior process of the ringwall has a central notch and the expansion of the shaft of the penis (fig. 81) behind the suspensory ligament is accentuated inferiorly by the development of a low pointed prominence. The clasp (fig. 82) resembles *chitralensis*.

The female genitalia (fig. 83) resemble those of typical *chitralensis*. The structure is of relatively small size, and the auricles are long and narrow.

The male fore leg resembles that of *chitralensis*.



Figs. 80–83.—*Melitaea chitralensis enarea* Fruhstorfer. 80. Male genitalia, dorsal view. Bokhara; 81. Penis, lateral view. Bokhara; 82. Clasp, lateral view. Bokhara; 83. Female genitalia, dorsal view. "Samarcand."

This form has a wide distribution in south-east Bokhara and extends nearly as far north as the Alexander Mountains. The distribution area includes forms of *didyma* and other closely related species but fortunately *enarea* is not, as a rule, a difficult insect to identify on account of the prominent submarginal lunules. It is evidently very sensitive to climate and a remarkable pale form is described below. Fig. 2 is already somewhat modified by a drier climate. It probably represents the form originally described by Fruhstorfer and comes from the same district.

The few specimens seen with good data suggest that *enarea* flies from the end of May until early July at elevations of 6000 to 10,000 ft.

Localities :—Sussamyr Mountains (south of the Alexander Mountains), Katmen Tube, June/July (Tring). Bokhara: "Alai" (Brit. Mus.); Guttscha, ex coll. Gr.-Gr. (Brit. Mus.); Kuliat Province, S.E. Bokhara (Tring); Karategin Mountains, Dombratschi, 2000 m., July (L.G.H.); Peter the Great Mountains, Garm (Fruhstorfer). Pamirs: Chorog, Shugnan Province, W. Pamirs, 18 May/27 June, 8000 ft. (Sheljuzhko); Ishkashim (Kishlak Njut), S.W. Pamirs, 7/20 June (Sheljuzhko), small specimen.

Melitaea chitralensis enarea mod. ***permuta*** mod. n. Plate 6 fig. 7 ♂, 8 ♀.

In this mod. the upper surface of the male is orange-yellow and the markings are small and delicate. On the fore-wings the submarginal series is represented by a row of black dots and the characteristic lunules are not obvious. On the hind-wing the lunules are more developed particularly towards the anal angle. On the under surface the markings resemble those of *enarea* but the orange submarginal band of the hind-wing is usually narrow and the macules are discrete.

In the female the ground-colour of the upper surface is slightly paler. The black pattern is complete on the fore-wing with only a slight tendency to suffusion. The hind-wing is clear orange almost unmarked, the marginal border narrow.

The genitalia do not differ from those of typical *enarea*.

This form is described from five males and three females in the British Museum and from one male and three females in my collection. With one exception, these were all collected by Haberhauer. In each case the locality is given as Samarcand without further specification. I believe the specimens may have come from the Hazret-Sultan Mountains. The remaining specimen is labelled Aulie-Ata. The series is very uniform and the facies very unlike the typical form. In the male sex the resemblance to some forms of *didyma* is close, but in all specimens seen there are traces of a proximal border of black scales to the macules of the orange submarginal fascia on the under surface of the hind-wing.

It is probable that *permuta* is a desert modification.

14. ***MELITAEA SUTSCHANA*** Stgr. Plate 3 fig. 6 ♂, 12 ♀. Distribution Map 4, p. 185.

Mel. didyma var. *sutschana* Staudinger, 1892, *in* Romanoff *Mém. Lép.* **6** : 183. Loc. Sutschan district (Siberia).
Mel. didyma var. *sutschuana* Stgr. 1901, *Cat.* (Ed. 3) : 31.

Exp. alar. 42–46 mm.

In this rather large insect the fore-wings are often narrow and somewhat produced apically. In the male sex the ground-colour of the upper surface is reddish-orange as a rule. The black markings are often very complete and regular. In particular the post-discal series of the hind-wing is well developed. On the under surface of the fore-wing the black markings are much less conspicuous. On the hind-wing the orange fasciae are wide and solid. The black markings are variable, sometimes strongly developed.

In the females the ground-colour of the upper surface is whitish or yellow. There is usually a very marked greenish-black suffusion, particularly intense on the hind-wings. The under surface resembles that of the male.

The male genitalia (fig. 84) are characterised by the very prominent spine of the clasp which is sometimes notched as in the specimen figured. The posterior processes are frequently asymmetrical. A lateral view of the clasp is shown in fig. 85. The penis-groove is nearly closed on each side by the lingulae. The harpe is small and devoid of teeth in all specimens examined. The penis (fig. 86) is stout and straight except the distal extremity, which is sharply upturned. In some specimens there is a small dorsal spine near the posterior extremity, but the development of this appears to be inconstant.

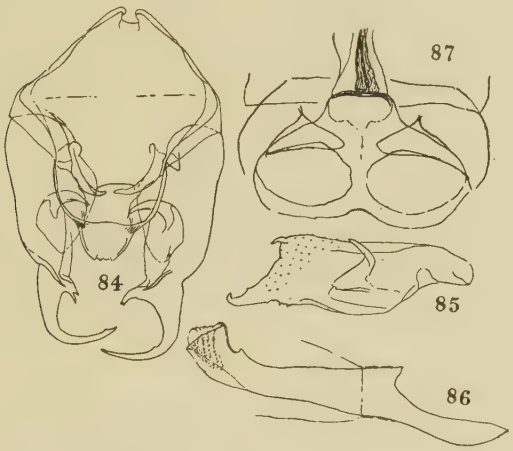
The female genitalia (fig. 87) closely resemble those of *didyma* but the cone is slightly more pronounced.

The species has a wide distribution is eastern Asia and extends from the Pacific coast nearly as far west as Lake Baical. The eastern specimens are

often less completely marked and these are described below as *yagakuana* Mats. I have no records of the elevation at which this insect occurs. It is sometimes confused with *latonigena* Ev., possibly on account of the dark females, but the two species are really quite obviously distinct. I have seen many specimens from Tjutju-ho 400 miles north of Vladivostok. These are very variable and the typical *sutschana* and the form *yagakuana* are about equally represented.

The male lectotype chosen from the series in the Staudinger collection closely resembles the specimen figured but on the upper surface the markings are not quite so complete.

Localities :—Pokrofka, no further data, several specimens; Pompejefka, Little Kingan Mountains, June (Tring); Tjutju-ho, no further data (Tring); many specimens labelled Amur, no further data; Sutschan (about 100 miles N.E. of Vladivostok *teste* Staudinger, *loc. cit.* : 91 footnote).



Figs. 84–87.—*Melitaea sutschana* Staudinger. 84. Male genitalia, dorsal view. Amur; 85. Clasp, lateral view. Amur; 86. Penis, lateral view. Amur; 87. Female genitalia, dorsal view. Amur.

Melitaea sutschana mod. ***yagakuana*** Mats. Plate 6 fig. 1 ♂.

Mel. didyma yagakuana Matsumura, 1927, *Ins. Matsum.* **1** : 164. Loc. South Manchuria, coast region of Prov. Yugakujo, 3.ix.1923.

In this form the black markings on the upper surface are much less complete. In particular the post-discal area of both wings is clear orange. In some specimens the forewings are more ample and less pointed. On the under surface the black markings are small and indefinite but the orange submarginal band on the hind-wing remains wide.

The male genitalia resemble those of the typical form except that in one specimen examined the penis is without the small dorsal spine.

This insect was described by Matsumura from a single aberrant specimen taken in south Manchuria. I think there is little doubt that it is a form of *sutschana* which shows in an extreme degree the characters of the south-eastern race, for which I have used the name. The specimen figured is not particularly well marked. Since the drawing was made I have seen others in which the weak black markings on the distal areas of both wings entirely alter the general appearance of the species.

This form is found in the southern and eastern districts of the distribution

range, particularly near the Ussuri River. I have already referred to its occurrence at Tjutju-ho with typical *sutschana* and intermediate specimens. It is possible that *yagakuana* demonstrates the same tendency to the development of large and brightly coloured races which is seen in several Melitaeid butterflies which occur in the extreme east of Asia. The only record of altitude is that of 2500 metres given below.

Localities :—Ussuri : Anutschino, June (Brit. Mus.); Wahk-Pluss (source of the Iman) June (Tring); Tjutju-ho, with many typical specimens (Tring). Corea : Poktussan, July, 2500 m. (L.G.H.); between Corea and Amur (Brit. Mus.).

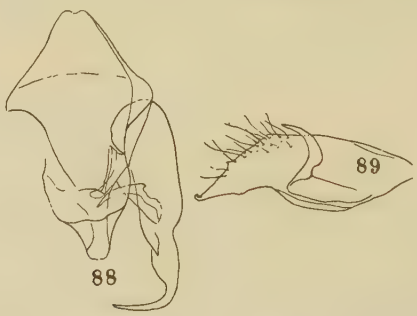
Two aberrations of *sutschana* are named by Kardakoff in 1928, *Ent. Mitt.* **17** : 270. The first is ab. *kalugini*, which refers to strongly melanic specimens presumably of the male sex. This is said to be very rare. The second is ab. *robiginosa* in which the under surface of the hind-wing is uniform ochreous in colour, without yellow. The orange fasciae therefore show little contrast against the ground-colour. I have seen two specimens with this tendency from Anutschino. Both the aberrations mentioned came from Ussuri.

15. *MELITAEA ACREINA* Stgr. Plate 5 fig. 12 ♂. Distribution Map 4, p. 185.

Mel. acreina Staudinger, 1886, *Stettin. ent. Ztg* **47** : 233. Loc. Ferghana, Kokand.

Exp. alar. 44–50 mm.

In this striking insect the upper surface is pale buff-yellow with a faint brownish wash towards the outer margin of the fore-wing. The markings are of dark brown. They are



Figs. 88–89.—*Melitaea acreina* Staudinger. 88. Male genitalia, dorsal view. "Samarcand"; 89. Clasp, lateral view.

almost or quite absent in the basal area. The discal series of the fore-wing is represented by the four costal macules and a round spot in cellule 1b. A short stria near the costa indicates the post-discal series, and the wing tip may be suffused with brownish. There is usually a complete series of delicate submarginal lunules before the fine marginal line. The hind-wing is unmarked except for the submarginal macules and a fine terminal line. I have one specimen which shows the two lower spots of the discal series.

On the under surface the submarginal lunules are absent. Traces of the usual black discal spots can usually be seen across the hind-wing.

The female is slightly larger than the male, and the pattern is a little more complete.

The male genitalia (fig. 88) closely resemble those of *didyma*. The tegumen is long and narrow, and the clasp (fig. 89) lacks a well-formed spine. The lingula partially closes the penis-groove on each side. The penis is nearly straight, the apex slightly upturned (not figured).

The female genitalia have not been examined.

This well-known species is a near ally of *P. didyma*. It presents the pale colour, reduced black markings and lack of sexual dimorphism characteristic of desert forms throughout the genus. The facies is so different from that of all other species that no confusion can occur. Little is known of its distribution. Grum mentions the saline steppes between Marghilan and Kokand in April and early May (1894, *in* Romanoff *Mém. Lép.* **4** : 434). All specimens in British collections are old and without proper data.

Localities : —Kokand (L.G.H.); Marghilan and New Marghilan (Brit. Mus.); Namangan (Brit. Mus.); many specimens labelled Fergana and Turkestan etc.

The five following species, *lunulata*, *fergana*, *ambrisia*, *infernalis* and *shandura*, form a small and definite group which is particularly interesting on account of its distribution. The species are all confined to the great mountain ranges of central Asia, and extend from the Karakorum through the Pamirs, Alai and Thian-Shan to the Boro-Choro Mountains. A form of *ambrisia* also occurs in Persia. All are rare insects, and the material at my disposal is scanty and the available data inadequate. The butterflies occur, apparently without exception, in the high alpine zone at elevations of 10,000 to 12,000 ft. The structure of the male genitalia diverges somewhat from that of *didyma*. The ringwall is shorter and the posterior processes of the scaphium often highly developed. The posterior process of the clasp is wider, usually deeply notched, and there is no spine on the tuberculated area. The free portion of the harpe is often large, and may be provided with elaborate teeth. The penis is horizontally flattened in all species examined, straight and with a small ostium-keel. The female genitalia of *fergana* and *lunulata* are quite typical of the *didyma* group. The short and hairy labial palpi also recall *didyma*. The very localised *shandura* is the most divergent form.

With such meagre material it is useless to attempt to give details of distribution for each species, but I have included a map of the group distribution (Map 3), which clearly has a zoo-geographical significance.

16. ***MELITAEA LUNULATA*** Stgr. Plate 7 fig. 1 ♂, 7 ♀. Distribution Map 3, p. 183.

Mel. saxatilis var. *lunulata* Staudinger, 1901, *Catalogue* (Ed. 3) : 30. Loc. Mountains of Issyk-Kul and Tashkent.

Fore-wing 19–24 mm.

On the upper surface the ground-colour of the wings is intense orange-red.

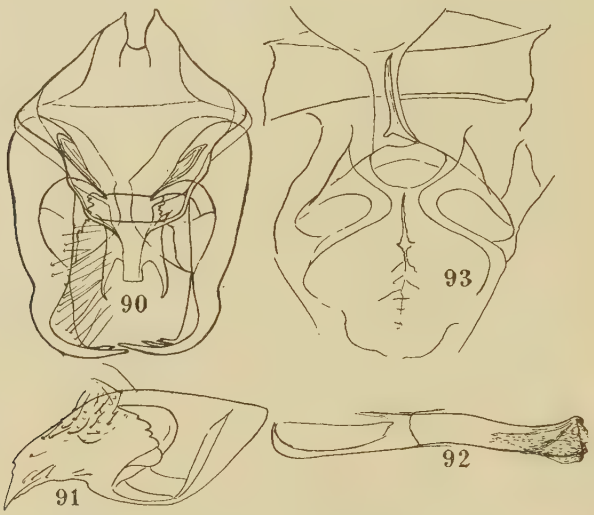
This handsome insect can be recognised immediately in the male sex by the complete submarginal series, which appear on the fore-wings as rounded spots, on the hind-wings as thick crescents. The discal markings are little developed but the usual black suffusion is present at the wing bases. The marginal line is fused with the marginal internervular spots to make a heavy black border to both wings.

On the under surface the apex of the fore-wing is greyish. The ground-colour of the hind-wing is also grey. The orange basal and submarginal bands are broken and diminished. The latter appears as a series of orange crescents. The usual black spots are present, those across the disc somewhat exaggerated.

The female is larger than the male. On the upper surface the markings are more complete. The discal series is usually continuous and the submarginal series frequently fused with the marginal border which appears very wide. The markings on the under surface resemble those of the male.

The male genitalia (fig. 90) are very distinctive. The tegumen and scaphium are highly developed. The clasp (fig. 91) terminates in a single strong tooth, above which are several smaller teeth diminishing in size from behind forwards. The harpe is a remarkable structure. It is short, wide and strong, directed medially. The vertical portion is expanded into a wide comb-like structure armed with numerous strong teeth, which can be clearly seen in the dorsal view. The penis is nearly straight, provided with ample ostium folds and a small ostium-keel (fig. 92).

I have been able to examine only two specimens. The female genitalia (fig. 93) are of the usual type. In the single specimen examined the extensive scutum provides an unusual feature.



Figs. 90–93.—*Melitaea lunulata* Staudinger. 90. Male genitalia, dorsal view. "Samarcand"; 91. Clasp, lateral view; 92. Penis, dorsal view; 93. Female genitalia, dorsal view. Alexander Mountains.

Distribution. Very little is known of the distribution of *lunulata*. It extends farther north than most members of the group. Staudinger described the species from the Issyk-Kul and Tashkent. There is a good series from the Alexander Mountains in the British Museum and also specimens from Tashkent. *P. fergana* Stgr. also occurs in this district and I have seen a pair from Djanbassar in the east Alexander Mountains and the species is also reported by Wagner from the country south-east of Issyk-Kul. The chief distribution centre of *fergana* is probably farther south than that of *lunulata* but it is quite possible that the distribution areas of the two insects overlap.

The female specimen illustrated is the lectotype chosen from the original series in the Staudinger Collection.

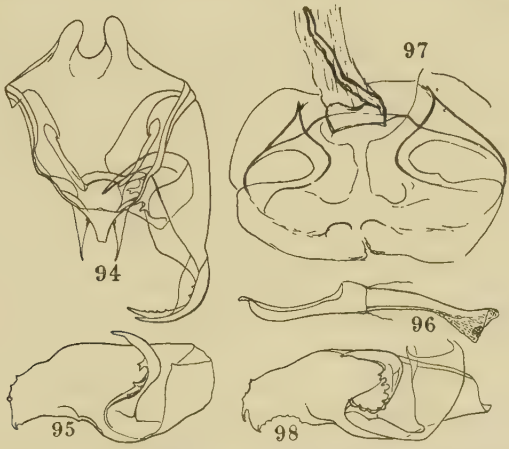
Localities :—Alexander Mountains, no further data (Brit. Mus.); Tashkent, no further data (Brit. Mus.); Issyk-Kul, Staudinger, *loc. cit.*

17. ***MELITAEA FERGANA*** Stgr. Pl. 7 fig. 3 ♂, 10 ♀. Distribution Map 3.

Mel. fergana Staudinger, 1882, *Berlin. ent. Z.* **26** : 169. Loc. Alai Mts.
Mel. fergana Alpheraky, 1881, *Hor. Soc. ent. Ross.* **16** : 404 *nom. nud.*
Mel. saxatilis var. *fergana* Staudinger, 1886, *Stettin. ent. Ztg* **47** : 232.
Mel. saxatilis var. *fergana*, Groum-Gr., 1890, *in* Romanoff *Mém. Lép.* **4** : 432, Pl. XII.

Fore-wing ♂ 19–23 mm., ♀ 20–26 mm.

In this insect the ground-colour of the upper surface varies from sandy yellow to bright orange-red. In the typical form the upper surface is very fiery. The black outer-marginal border is distinct, widest at the apex of the fore-wing. It is fused with the marginal internervular dots which are enlarged on the hind-wing and frequently on cellules 3 and 4 of the fore-wing also. A wide black suffusion extends from the base of the fore-wing along the inner margin of the hind-wing nearly as far as the anal angle. In the male the discal series of the fore-wings is not rarely complete. The cellular striae and orbicular mark and traces of a submarginal series may be faintly indicated. The hind-wings are unmarked above. On the under surface the ground-colour is greyish or sandy-yellow. The usual black striae are present. The much-broken basal fascia and the wide submarginal fascia are only slightly more reddish than the ground-colour. The marginal border is reduced to a fine black terminal line.



FIGS. 94–98.—*Melitaea fergana* Staudinger. 94. Male genitalia, dorsal view. "Fergana"; 95. Clasp, lateral view. "Ferghana" (*maracandica* Stgr.); 96. Penis, lateral view. Karakorum (*jacobsoni* Avin.); 97. Female genitalia, dorsal view. Thian-Shan; 98. Clasp, lateral view. Karakorum (*jacobsoni*).

In the female sex the black pattern on the upper surface is much more definite and complete. A series of yellowish macules is usually present external to the discal spots of the fore-wing.

In both sexes the fringes are chequered with black scales at the terminations of the nervures.

The genitalia of the male (fig. 94) are comparatively short. The scaphium projects posteriorly on each side as a narrow process below the conical tegumen. The elongated clasps (fig. 95) terminate in a double process and the harpe is long, the proximal limb provided with several strong teeth. The penis (fig. 96) is horizontally compressed, with a well-developed ostium fold and a small ostium-keel. It is therefore very distinctive. The female genitalia (fig. 97) are of the usual type and closely resemble those of *didyma*.

This is an insect of the high alpine zone where it flies on grassy and stony places at an elevation of 9000 to 14,000 ft. As in the case of its close allies, it is very scarce in collections, and my material is quite inadequate for the proper study of such a variable species. Groum remarks: "Chaque vallée, chaque chaine de montagnes, nourrit une forme spéciale de cette espèce" (*loc. cit.* : 432). No doubt his knowledge of the species was extensive and my own

observations, based upon a meagre series from various localities, entirely confirm his conclusions. The known distribution extends from the Alexander Mountains in the north along the Thian-Shan and Alai Mountains into Bokhara. Still farther south-east it occurs in a slightly modified form in the Karakorum and Hindu Kush. The largest specimens I have seen are from "Naryn." In these the upper surface is bright reddish but the markings of the males are rather less complete and the fore-wing of the females less variegated with orange macules than in typical specimens from the Alai. Another climatic modification is described below, as is also the southern form which may perhaps rank as a subspecies. It is probable that these forms all grade into one another and that only extreme examples are sharply defined.

The specimen illustrated in fig. 3 is the lectotype from the Staudinger collection. The discal spots form a complete row across the fore-wing but this is not always the case.

Two specimens from Darwas, Bokhara, in the British Museum are labelled as *saxatilis darvasika* Avinoff, a name which, however, does not appear to have been published. They are perhaps rather pale and small and to some extent intermediate between *fergana* and the southern modification *jacobsoni*. In my opinion they do not require a special name.

Localities :—East Alexander Mountains—Djan-bassar in Brit. Mus. ex Avinoff; Alexander Mountains—Kappak, 14 July 1905, Tring Mus.; Western Thian-Shan—"Fort Naryn" many specimens; Alai Mountains—between Osch and Usgent, Tring Mus.; also many specimens without full data; Trans-alai Mountains—Arum-Kung in Brit. Mus. ex Gr.-Gr.; Bokhara—Darwas in Brit. Mus. ex Avinoff; Hazret-Sultan Mountains, coll. L.G.H.

Melitaea fergana mod. ***maracandica*** Stgr. Pl. 7 fig. 2 ♂; 8 ♀.

Mel. fergana var. *maracandica* Staudinger, 1882, *Berlin. ent. Z.* **26** : 169. Loc. Hazret-Sultan Mountains.

Mel. saxatilis var. *maracandica* Staudinger, 1886, *Stettin. ent. Ztg* **47** : 232; Groum-Gr., 1890, *in* Romanoff *Mém. Lép.* **4** : 432, Pl. XII.

This is somewhat smaller than the typical form. The ground-colour on the upper surface is pale and yellowish, the markings greyish rather than black. In the male sex the markings are much reduced, but the four costal spots are nearly always present, and these are placed in a straight row exactly at right-angles to the costa. In typical *fergana* these spots usually incline towards the outer margin of the wing. On the under surface the ground-colour of the hind-wings is very pale and usually nearly unmarked, except for traces of the submarginal fascia, characteristically narrow and slightly darker than the ground-colour.

In the female the markings on the upper surface are more complete than in *fergana*. The grey marginal border is interrupted by yellow spots between the nervures to make a really striking border of deep marginal crescents.

This modification is confined apparently to the most western districts of Bokhara, where it was found by Haberhauer in the Hazret-Sultan Mountains. It occurs also in the Ghissar Mountains. Nearly all the examples I have seen have been old specimens derived from Staudinger, probably part of Haberhauer's original series. I had considered *maracandica* specifically distinct from *fergana*, of which typical specimens seem to occur in the Hazret-Sultan Mountains, until specimens were available for dissection, when the genital armatures of the two forms were found to show no obvious distinction. I have also seen two specimens which appear intermediate between the two forms, and

I have therefore treated *maracandica* as *forma tempestatis*. It certainly has the appearance of a desert modification. Nevertheless the insects are so different in appearance that further consideration of a longer series is required before their relationship can be definitely settled.

The specimens figured on Pl. 7 are those chosen as lectotypes from the original series in the Staudinger collection. The male specimen is slightly more reddish and the markings on the under surface are more complete than is the case in several other examples.

Localities :—" Turkestan "; " Samarcand "; the majority of specimens are so labelled (type ♂ and ♀); Sarafschan, coll. L.G.H.; Hazret-Sultan Mountains, coll. L.G.H.; Hindu Kush, ex Gr.-Gr., one male Brit. Mus. coll.

Melitaea fergana jacobsoni (Avinoff *in litt.*) subsp. n.

In the British Museum collection there is a pair of *fergana* from the Pamirs separated under the unpublished name of *saxatilis jacobsoni* Avinoff, from whose collection they came. They resemble other specimens from the Pamirs and Karakorum, of which I have seen several, and which differ slightly from more northern examples.

The size is sometimes reduced, the tone of the upper surface is rather paler, and the discal spots on the fore-wing in the male are very small or absent. On the under surface the markings of the hind-wings are neat and fine but less confused than usual. The few female specimens seen resemble the males in having the markings on the upper surface somewhat reduced.

The difference is so slight that a varietal name would be scarcely needed, were it not that in three specimens from the western Karakorum examined there is a small difference in the shape of the harpe, which is a little wider than usual and provided with very numerous strong teeth (fig. 98). In typical *fergana* the harpe does not as a rule carry more than three or four teeth rather widely separated.

Localities :—Pamirs : Maz River (type) ex Avinoff in Brit. Mus. coll.; Tagdumbash, 14,000 ft., Brit. Mus.; Peik, June 1928, Brit. Mus. Hindu Kush : Karambar Pass, 4500 m., Sept., coll. L.G.H. West Karakorum : Ghujerab, 13,000 ft., 4 July, coll. L.G.H.; Khunjerab, 12,000 ft., 25 June, coll. L.G.H.

I have seen specimens from the Hazret-Sultan Mountains which are scarcely distinguishable from *jacobsoni*, but I do not know whether in these the harpe has the same structure.

18. ***MELITAEA INFERNALIS*** Gr. Plate 7 fig. 6 ♂, 12 ♀.

Mel. saxatilis var. *infernalis* Groum-Grshmailo, 1891, *Hor. Soc. ent. Ross.* **25** : 455. Loc. Umkangol, Boro-Choro Mountains.

Fore-wing 22–26 mm.

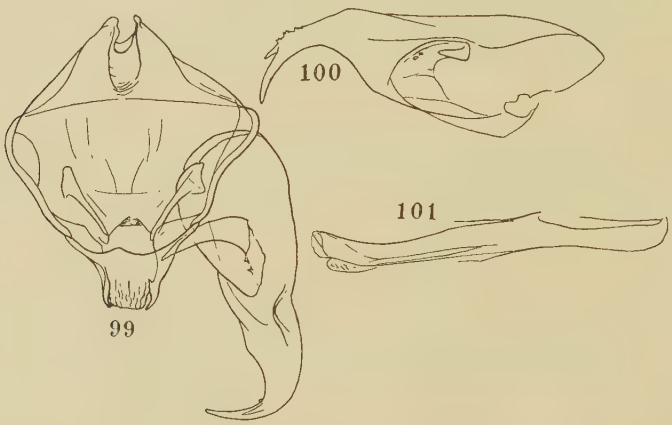
On the upper surface the ground-colour is orange with a rather yellowish tint. In the male the median series of the fore-wing is complete, but the markings at the base of the wing and in the cell are only faintly indicated. The black marginal border is strongly developed. On the hind-wing the usual black suffusion along the inner margin is continued to the anal angle where it fuses with the wide marginal border. The suffusion is very wide and extends into the discoidal cell and as one or two macules into cellules 2 and 3.

On the under surface the fore-wing is greyish near the tip but otherwise unmarked. The ground-colour of the hind-wing is grey. The basal markings are obscure, but the

orange submarginal fascia is clear, bordered internally and externally by dark grey crescents.

In the female the markings on the upper surface of the fore-wing are more complete. The submarginal lunules are present and form a continuous series. In all specimens there is a broad dark suffusion along the inner margin. On the under surface the hind-wing is almost entirely grey, the markings even more obscure than in the male.

The male genitalia (fig. 99) are short, and show a general resemblance to *fergana* Stgr. The tegumen is well developed and wide, but the scaphial elements are scarcely noticeable. The posterior process of the clasp is evenly curved inwards and downwards, and a fine spine is visible on the superior border. The strong harpe is directed horizontally inwards. Two small teeth can be seen at its base. In lateral view (fig. 100) three small notched teeth appear in the position of the superior angle. The penis (fig. 101) is flattened from above downwards. A small ostium-keel is present, and part of the ostium fold is modified, and although rather indefinite has the appearance of a morula.



Figs. 99–101.—*Melitaea infernalis* Groum. 99. Male genitalia, dorsal view. Boro-Choro Mts.; 100. Clasp, lateral view; 101. Penis, lateral view.

This handsome butterfly is very rare in collections. The original description is scarcely adequate, but fortunately the typical pair and four paratypes from Groum's collection are preserved in the British Museum. These are the only specimens I have seen.

19. ***MELITAEA AMBRISIA*** Higgins. Plate 7 fig. 5 ♂, 11 ♀.

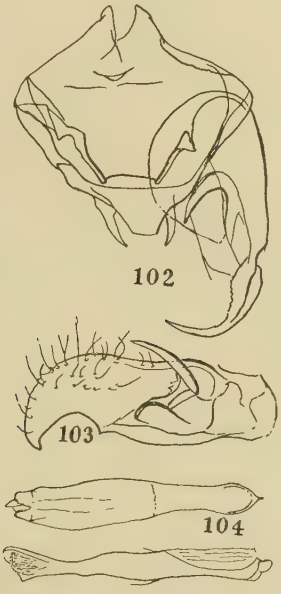
Melitaea ambrisia Higgins, 1935, *Entomologist* **68** : 112. Loc. Marghilan, Turkestan.

Fore-wing ♂ 19–20 mm., ♀ 19–22 mm.

This species is nearly allied to *fergana* Stgr. and resembles particularly the form *maracandica* with which it is often confused. On the upper surface the ground-colour is sandy yellow. The cellular striae and the orbicular mark are present on the fore-wings, where the complete series of discal spots forms the most prominent marking. The submarginal series is also present but very small and obsolete in cellule 1. The hind-wings are unmarked except for the extensive black basal suffusion and some indications of a submarginal series most obvious in cellules 6 and 7. Both wings show a narrow black marginal border, which bears some traces of the internervular spots found in *maracandica*. The fringes are white without black interruptions. On the under surface the fore-wings are

marked as above. The hind-wings are yellowish-grey, the transverse fasciae outlined by black dots and lunules, most definite across the disc, and a rather extensive black suffusion is present at the base. The black margin is not obvious but the edge of the wing is greyish and the minute internervular marginal spots are clearly seen. The female closely resembles the male, but the black markings are more complete and heavier.

The male genitalia (fig. 102) recall those of *fergana*. The chief difference is found in the clasp (fig. 103) which terminates in a single wide posterior process. The harpe is differently formed, more slender, with a few small teeth on the proximal limb. The penis is compressed (fig. 104) but slender in lateral view. A small ostium-keel is present. There has been no opportunity of examining the female genitalia.



Figs. 102–104.—*Melitaea ambrisia* Higgins. 102. Male genitalia, dorsal view. Bokhara; 103. Clasp, lateral view; 104. Penis, ventral view above, lateral view below.

Localities :—" Turkestan," no further data, Brit. Mus.; Marghilan, no further data, several specimens; Alai Mountains, no further data, L.G.H.; Alai Mountains—Artscha Barsh, Brit. Mus. (ex Gr.-Gr.).

Melitaea ambrisia alraschid subsp. n. Pl. 16 fig. 5 ♂.

Fore-wing 21 mm.

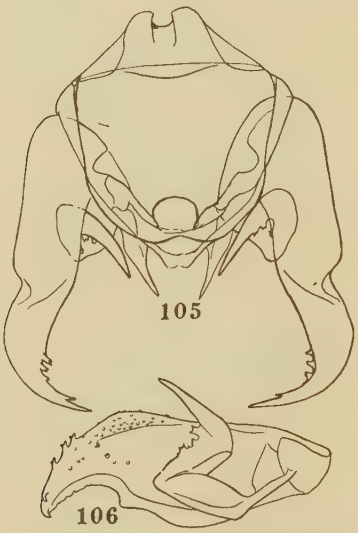
Differs in detail from *M. ambrisia*, and all markings less definite. On the fore-wing the orbicular mark is longer. The discal series is only faintly indicated in each cellule, with the two spots nearest the costa slightly more emphasised. The submarginal series represented by small dots. There are no markings in the discal area of the hind-wings. A wide black suffusion starts at the base of the fore-wing and extends from the base of the hind-wing as far as nervure 2. The costa of the fore-wing is narrowly black and a series of black internervular lunules extends along the outer margins of both wings just proximal to the fine black terminal line. On the under surface of the fore-wing the fine pattern is reproduced in grey along the outer margin and at the apex. The hind-wing is yellowish-grey with darker grey markings resembling *ambrisia* but less definite.

The male genitalia (fig. 105) differ slightly from two preparations of *ambrisia* from Turkestan. The posterior process of the clasp (fig. 106) shows three prominent teeth from the superior border and another tooth which appears slightly before the apex. The harpe is slightly heavier.

Locality. Described from a single male specimen labelled " Persia " without further data.

Type in the British Museum.

This form is so near *ambrisia* that it can reasonably be looked upon as a subspecies of that insect, in spite of the small differences in the genitalia. The appearance of this characteristic Alai butterfly in Persia is interesting. It is



Figs. 105–106.—*Melitaea ambrisia alraschid* Higgins. 105. Male genitalia, dorsal view. " Persia "; 106. Clasp, lateral view.

unfortunate that better data are not available with the specimen. Perhaps others may soon be found.

Note. Brandt, in 1939, *Ent. Rundsch.* **56** : 12, recorded that the original type specimen of *M. casta* Kollar, in the Vienna Natural History Museum, has been carefully examined by E. Pfeiffer, who reported that *casta* was a " *saxatilis* " form. It may prove to be identical with *alraschid*, which is the only member of the group I have seen from Persia.

20. ***MELITAEA SHANDURA*** Evans. Plate 7 fig. 9 ♂.

Mel. shandura Evans, 1924, *J. Bombay nat. Hist. Soc.* **30** : 90. Loc. Shandur in Chitral.

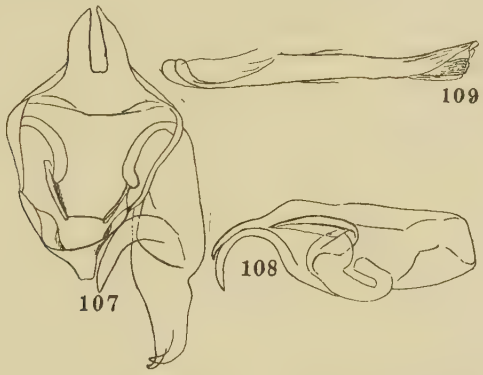
Fore-wing ♂ 22 mm.; ♀ 25 mm.

M. shandura is a very distinct form which can scarcely be confused with any other species. Although a scarce insect, it has been known for many years. It is referred to by Evans in 1912, *J. Bombay nat. Hist. Soc.* **21** : 582, as *shandura* Christoph. I can find no published description by Christoph, and that of Evans

referred to above seems to be the first. It is not very explicit but fortunately the type pair from Christoph's collection is preserved in the British Museum.

On the upper surface in this species the ground-colour is pale brownish-yellow. A wide black basal area extends from the costa of the fore-wing to the anal angle of the hind-wing. On the fore-wing some indistinct yellowish macules can be seen on each side of the heavy median fascia, and the submarginal lunules form a continuous series. On the hind-wings the nervures are outlined by black, but the discal and submarginal markings are indistinct. On the under surface the markings are less prominent. The ground-colour of the hind-wings is greyish-yellow. The usual transverse fasciae and striae are present but all markings are very obscure.

The fringes are white chequered with black at the termination of each nervure.



Figs. 107–109.—*Melitaea shandura* Evans. 107. Male genitalia, dorsal view. Shandur Pass; 108. Clasp, lateral view. Shandur; 109. Penis, lateral view. In dorsal view the penis is wide.

The male genitalia (fig. 107) are distinctive. In the specimen examined the small cone-shaped tegumen has no scaphium. The saccus is large and elongated. The posterior process of the clasp (fig. 108) is bifid, and strongly curved from above downwards. The harpe is very strong and without teeth. The penis, which is horizontally compressed and nearly straight, shows a small ostium-keel (fig. 109).

It has not been possible to examine the female genitalia.

Localities :—Christoph's original specimens are labelled " Chitral 11,000 ft." Three other specimens taken by Brigadier Evans are from Shandur Lake, Chitral, at 11,000 ft., found in Alpine surroundings. Avinoff, in a MSS. note, records this species flying at Darwas with *fergana*.

21. ***MELITAEA ATHENE*** Stgr. Plate 2 fig. 3 ♂, 9 ♀. Distribution Map 4.

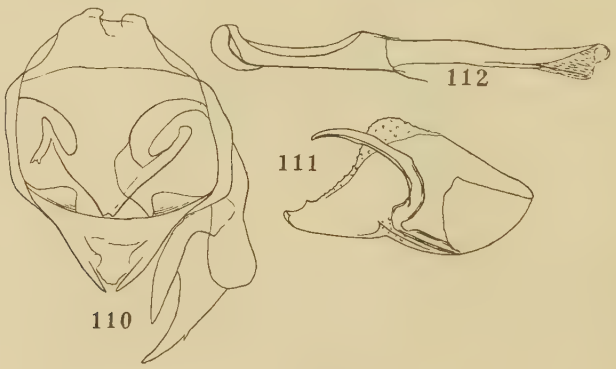
Melitaea athene Staudinger, 1881, *Stettin. ent. Ztg* **42** : 266. Loc. Saisan (Tarbagatai).

Fore-wing 20–23 mm.

This is an insect of medium or large size. On the upper surface the fore-wings show the usual marks at the base and in the cell. The first four spots of the discal series are large and oval, and the last spot in cellule 2 is often accentuated. The intervening spots are small or obsolete. The post-discal area is wide, the marginal series and more rarely the post-discal series are sometimes represented by four or five small spots near the costa. There is a

pale subapical mark. The marginal internervular spots are large and fused with the marginal border. On the hind-wings the discal series is usually represented by a few small marks and there is an extensive black basal suffusion. The marginal spots are boldly marked against the black marginal border, alternating with the black interruptions in the white fringe to produce a sinuous effect. On the under surface the fore-wings are marked as above, the submarginal series is distinct only in cellules 5–9. The basal orange fascia of the hind-wings is much reduced and broken up. The submarginal orange fascia is narrow and composed of a series of separate orange crescents which are bordered distally by a series of black lunules, deeply excavated in cellules 2, 3 and 4. The marginal fascia of ground-colour is wide, and the internervular dots are distinct and often large. The sexes are similar.

The male genitalia (fig. 110) show a conical tegumen with well-developed scaphial elements. The ringwall is contracted posteriorly almost to a point in a most unusual formation. The clasp (fig. 111) is short, flattened and somewhat triangular. The wide posterior process is slightly incurved and tapers rapidly to a point. Near the tip a small



Figs. 110–112.—*Melitaea athene* Staudinger. 110. Male genitalia, dorsal view. Saisan; 111. Clasp, lateral view; 112. Penis, lateral view.

spine is present on the superior border. The harpe is long and slender, directed backwards and slightly inwards. The penis (fig. 112) is straight and slender with an ostium-keel larger than in any other member of the group.

This interesting insect is easy to recognise and full of character, but the distinctive points are hard to define. The elaborate tegumen and also the ostium-keel of the penis recall the *fergana* group, in particular *lunulata* and *shandura*. The triangular clasp forms a transition to the very atypical organ seen in *trivia*. It has not been possible to examine the female genitalia, and the description and figures given are made from a single preparation of the male. The species is represented in the Brit. Mus. by five examples derived from various collections, all of which probably form part of Staudinger's original material. I have not seen a specimen with good data, and no record of its capture since the original description was published.

The figures are drawn from the lectotypes chosen from the series in the Staudinger collection.

Localities :—Tarbagatai Mountains, Saisan (Staudinger); "Tura"; Central Asia, no other data; 3 ♂♂, 2 ♀♀, Brit. Mus.

22. ***MELITAEA TRIVIA*** W.V. Plate 9 fig. 1 ♂. Distribution Map 4.

Pap. trivia Wiener Verzeichnis, 1775, *Syst. Verz. Schmett. Wien.* : 179. Loc. Vienna.
Pap. iphigenia Fsp. 1782, *Die Schmett.* **1** (2) : 128. Loc. Austria. *nec Pap. iphigenia* Cramer 1775.
Pap. fascelis Esp. 1784, *loc. cit.* **1** (2) : 171. Loc. Sarepta.
Pap. antigonus Herbst, 1800, *Natursys.* **10** : 212. Nom. n. pro *iphegenia* Esp. preoccupatum.

Distribution. In Europe *trivia* is widely distributed in southern Russia. There are few Russian specimens in English collections, but according to Erschoff and Felder it occurs from Moscow to the Caucasus and from Uralsk to Podolia. It is common round the Black Sea, whence the range extends through Hungary to Lower Austria. In this part of its distribution area the insect appears to spread over the Danube basin, which it ascends as far as the Trauntal in Lower Austria. Records from Bavaria exist, but it is doubtful whether its occurrence there is more than accidental. In the west it becomes rapidly scarce, although its presence is recorded in Styria, Istria and Carinthia. In addition to the Danubian distribution region, isolated colonies exist in western Europe. The insect is known to occur in several localities in Italy, in Calabria, near Turin and on Lake Garda. These localities are now scarcely recognised, although well known to Duponchel (1832, *Hist. nat. Lép. Diurnes* (*Suppl.* 1) : 140) and to Speyer (1858, *Geogr. Verbreit.* : 159).

There are numerous old records from Bolzano and other localities on the southern slopes of the Alps. Dannehl gives only the Val Sugana (1925, *Ent. Z.* **39** : 48), and it is likely that the insect is dying out in this region. It is much commoner, but still very local, in Spain and Portugal, where it occurs from the mountains of Arragon westwards to the Atlantic. Most of the specimens I have seen from Italy and Spain have been a good deal paler than Balkan examples, and they are best united with the form *pseudodidyma* Rebel from Asia Minor.

The insect is not found in the Pyrenees or in southern Spain. It is absent also from northern Africa and from the large Mediterranean islands. In Asia the species flies over a wide area. It is common in Asia Minor and Syria, particularly in hilly districts. In the south of this region appears a further grade in the restriction of the black markings associated with small size known as *robertsi* Butl.

Farther east records and material are very scanty, but the insect certainly occurs in Transjordan and it is recorded by Romanoff from Transcaucasia. The few Persian examples I have seen are all without accurate data; no doubt it inhabits the Elburz district. The distribution there is little known and it is not recorded by Le Cerf from Luristan. In parts of Turkestan the butterfly seems to be commoner, the specimens often very small and pale *catapelia* Stgr. It is abundant among the foothills of the eastern mountains in the neighbourhood of Samarcand, and extends southwards from there through Bokhara to Afghanistan and Chitral, to cross the mountains to reach the plains of the north-west Punjab. There is no reason to suppose that it is absent from the Turkestan plain, although I have seen no specimens, and there are records too from the southern Kirghiz steppes. In this huge distribution area the local variation of *trivia* is very striking. Large and richly coloured specimens appear in the northern districts. Farther south in Spain, Italy and Asia Minor smaller and paler specimens are found, while the smallest and most weakly marked examples are found in Fergana and Afghanistan. Proceeding from north to south, there is a gradual modification, and intermediate specimens are frequent. There can be no doubt that this variation is largely due to ecological conditions,

probably to changes in climate to which the species appears unusually sensitive. Much of the variation must therefore be regarded as seasonal.

M. trivia is interesting in many ways. I regard it as an archaic form. The very unusual structure of the male genitalia indicates an isolated species, in this respect nearest to *athene* Stgr. The presence in the hind-wing of the lower discocellular nervure is a peculiarity shared only by *yuenty* Ob. The relationship to *didyma* is certainly distant, far more so than the similar wing-markings of the European forms would suggest. The extensive range of *trivia*, from Portugal to Chitral, also presents some interesting problems. In the west of Europe the distribution is remarkable for discontinuity. There can be few butterflies which show such definite widely separated distribution areas, and in these it is usually extremely localised. Such a distribution is not surprising in an insect which may represent an archaic type.

Fore-wing ♂ 16–20 mm., ♀ 20–24 mm.

In this variable insect the wing-markings closely resemble those of *didyma*. On the upper surface the ground-colour is bright reddish-orange, the black markings heavy, the deeply lunulate submarginal lunules fused with the black marginal border. On the under surface of the hind-wings the ground-colour is canary yellow, the orange tone of the basal and submarginal fasciae usually very intense. The following characters are fairly constant:—

1. The black mark enclosing the discocellular nervure of the fore-wing is usually a well-formed oval often large for the size of the insect.

2. On the hind-wing the black discal marks are usually prominent and are placed rather distally. This is particularly obvious on the under surface where the black V-mark in cellule 1c almost touches the orange submarginal crescent.

3. The black margins of the spots of the proximal orange fascia on the under surface of the hind-wing are reproduced on the upper surface. This basal pattern is distinctive, particularly a black-edged orange crescent enclosing the distal extremity of the discoidal cell.

4. In European examples the submarginal series of both wings is composed of well-developed black crescents, not thickened into macules. This feature is much less obvious in most Asiatic specimens.

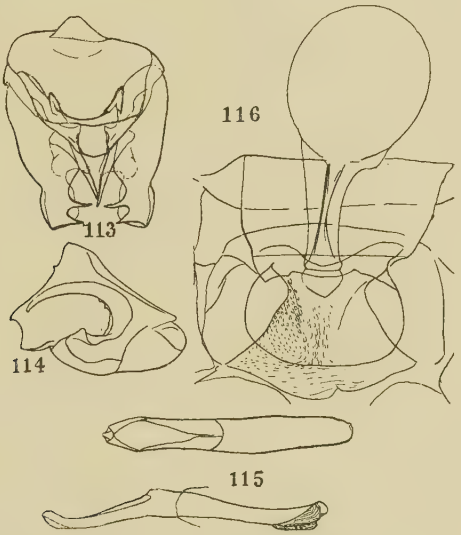
The female is usually larger than the male, and the ground-colour is often paler. In some localities specimens occur which show traces of the black suffusion so common in the females of *didyma* and other species. In both sexes the inferior discoidal nervure of the hind-wing is represented by a short spur, which is sometimes exaggerated, and in rare cases the cell may be entirely closed. This useful specific character is best seen on the under surface. It occurs also in *yuenty* Ob.

Genitalia. The male genitalia (fig. 113) are small. The tegumen is narrow and conical. The short ringwall shows little trace of a penis-groove. The saccus projects forwards and upwards as a narrow tongue which may be slightly excavated in front. The clasp (fig. 114) is wide posteriorly and roughly triangular in shape. Viewed from above, two processes are present projecting inwards from the superior angle. The harpe is long and directed posteriorly and slightly medially. Inferiorly it is armed with teeth and rather resembles the form found in *athalia*. The penis (fig. 115) is slender, slightly curved and gaping posteriorly. The ostium folds are reduced and there is no obvious morula. Seen from below, it is much wider.

The female genitalia (fig. 116) are of the usual type. The auricles are very small. A large and almost quadrilateral external flap forms a good specific character.

The larva and pupa are well known and several excellent figures are available. I have not found an adequate figure or description of the egg. The

imago flies in Europe from May until August, and from March until September in the hot districts of central Asia. It occurs especially in hilly country, where it reaches an altitude of over 4000 ft. Two or more broods are said to occur. In Bulgaria in July I found larvae of all sizes, and pupae also, while the insect was still flying commonly and fresh. In some localities therefore it is possible that the emergence continues throughout the summer. Staudinger also suggested that this might be the case at Amasia (1879, *Hor. Soc. ent. Ross.* **14** : 267). The typical form of *trivia* is developed only in the relatively moist and temperate regions of Europe. It varies a good deal in size, but on the whole it is the largest known to occur. Very small examples are not infrequent, particularly in the later emergence. Grund suggests that the smaller and paler *nana* is the predominant second-brood form near Agram (1913, *Int. ent. Z.*



Figs. 113–116.—*Melitaea trivia* W.V. 113. Male genitalia, dorsal view. Bulgaria; 114. Clasp, lateral view. Budapesth; 115. Penis, lateral (below) and dorsal views. Budapesth; 116. Female genitalia, Bulgaria.

7 : 128). These are referred to by Staudinger as *nana* (1871, *Cat.* (Ed. 2) : 18), but if a name is needed *antigonus* Herbst has priority. The largest specimens are sometimes referred to as *fascelis* Esp. This form was described from Sarepta and specimens I have from there and from other localities in southern Russia are not distinguishable from Hungarian and Austrian specimens and they are frequently rather small. It is probable that the largest known specimens occur in Bosnia and Bulgaria. These have been named *lathon* by Fruhstorfer (1916, *Arch. Naturg.* **82** (A) (2) : 13) from Bosnian specimens. I have taken small, medium and large forms all flying together in Bulgaria, and it is certain that no racial distinction can be made on this account. In all localities examples taken in the later months are often paler as well as smaller than those taken earlier in the year.

Localities :—Common and widely distributed in southern Russia, southern Rumania, Hungary, Bulgaria and in Greece north of the gulf of Corinth. Not rare in Lower Austria as far west as the Trauntal. Recorded as scarce and local

in northern Rumania, Galicia, Styria, Carinthia and Istria. In Jugoslavia it is local and uncommon, especially in the west.

Melitaea trivia mod. ***pseudodidyma*** Rebel. Pl. 9 fig. 7 ♂.

M. trivia pseudodidyma Rebel, 1905, *Ann. k.k. Hofmus. Wien* **20** : 193. Loc. Erdschias Dagh and Konia (Asia Minor).
M. trivia catapeloides Stauder, 1918, *Z. wiss. InsectenB.* **14** : 57. Loc. Paola in Calabria (Italy).
M. trivia race *ignasiti* de Sagarra, 1926, *Buttl. Inst. Catal. Hist. nat.* (2) **6** : 130. Loc. Portugal.
M. didyma aabaca Fruhstorfer, 1917, *Soc. Ent.* **32** : 19. Loc. Spain—Castille. Ref. to *trivia teste* Belter, 1934.

Fore-wing ♂ 17–20 mm., ♀ 20–23 mm.

This form resembles typical *trivia* in size, or is only slightly smaller. On the upper surface the ground-colour is clear yellow, the black markings less heavy. The submarginal lunules are not completely fused with the black marginal border, and they may be a good deal reduced, but the discal spots are usually large and clear. On the under surface the colouring is less intense than in the typical form and the black spots are smaller. On the hind-wings the ground-colour is very pale.

This modification was described from Asia Minor, where it is certainly common and probably the dominant form. In the north it passes insensibly into typical *trivia* which flies around the Black Sea, while towards the south and at low levels the specimens are further modified in the direction of *robertsi*. There are good series in the Tring Museum from Spain and Portugal. These are very uniform with a clear yellow ground-colour and rather bold markings. Specimens from Turin in northern Italy appear to me identical. They approach the Asiatic *pseudodidyma* very closely and can be scarcely separated individually. In a series I think the European specimens have wider and rounder fore-wings. Examples from the Calabrian Mountains of central Italy and from the Majella are transitional. The ground-colour on the upper surface is darker orange-yellow and the submarginal black lunules touch the black margin. They are scarcely darker than specimens I have from Trieste.

Localities :—Asia Minor : widely distributed and common. Examples from the southern Kirghiz steppes and from the Transcaucasus should probably be referred here. North Italy : scarce and local; Susa, near Turin, 14 May; 30 July (2nd gen.) Lago di Garda, the first brood is said to appear about 15 May. Central Italy : Calabria, Aspromonte, 950 m., 2 July 1920 (Stauder); Paola, 400-600 m. (Stauder) (type of *catapeloides* Staud.); San Fili, 900 m. (Verity and Querci); Majella Mountains, 20 July 1906, San Lucca above Reggio; Abruzzi, Oricola, 800 m. (Rostagno); Paliano, 500 m.; Rome (Calberla); Genzano, 600 m. (Verity). Spain : Local in the central Sierras; Arragon, Noguera, 1400 m., July (Romei); Catalonia, Seva, 700 m., August (probably gen. 2); New Castile, Tragacete, 1400 m., 3 Aug. 1928 (Querci); La Granja, June; Leon, Riano, 3500 ft., 16 July; Casayo, N.-W. Spain, 2 July 1906 (Chapman). Portugal : Sierra de Estrela, 1000 m., July/August (2nd gen.); type of *ignasiti* de Sagarra.

Note. According to Belter 1934, *Arb. morph. tax. Ent.* **1** : 114, *M. didyma aabaca* is a form of *trivia*. He examined the original type specimen in the Fruhstorfer collection, and stated that it was taken by Korb in Anatolia !

Melitaea trivia mod. ***robertsi*** Butl. Pl. 9 fig. 2; 8 ♂; 9 ♀.

Mel. robertsi Butler, 1880, *Proc. zool. Soc.* **1880** : 406 (Pl. 39). Loc. Rokeran, near Candahar, Afghanistan.
Mel. trivia var. *syriaca* Rebel, 1905, *Ann. k.k. Hofmus Wien* **20** : 13. Loc. Beirut and Haifa.
Mel. trivia var. *catapelia* Staudinger, 1886, *Stettin. ent. Ztg* **47** : 231. Loc. Samarcand.

Note. The name *robertsi* Butl. is unfamiliar and has been often wrongly employed. It should replace *syriaca*. The type specimen, a female, is now in the British Museum.

In the male the average length of the fore-wing is about 15 mm. On the upper surface the ground-colour is pale, and in addition the black markings are reduced. The submarginal series is often poorly developed, and particularly on the fore-wing the spots often lose their characteristic semilunar shape. On the under surface the ground-colour of the hind-wings remains pale yellow, or is white (*catapelia* Stgr.) in which form the yellow submarginal lunules are often bordered proximally with black.

Identification of this insect by the superficial characters alone is not always easy. In the east there is little difficulty as no similar butterfly of such small size has yet been found in central Asia. It is most likely to be confused with the small forms of *dodgsoni* which fly in Syria and Baluchistan. In this butterfly, however, the oval mark at the distal extremity of the cell of the fore-wing is small and narrow, and the characteristic *trivia* pattern at the base of the hind-wing on the upper surface is not obvious. In most forms of *dodgsoni* the orange lunules of the submarginal row on the under surface of the hind-wing are delicately bordered all round with black. This is rarely the case in *trivia* except in specimens from Ferghana, but the character is absent too in the later broods of *dodgsoni paphlagonia*, and I have never seen it at all in *Mel. montium* of the Lebanon, where the similarity between the two insects is sometimes very puzzling. Also in the Lebanon *trivia* comes into relationship with *deserticola macromaculata*, but the strongly convex outer margin and large discal spots of the fore-wing of this butterfly should prevent confusion. In addition *deserticola* is usually slightly larger, and on the under surface of the hind-wings the orange submarginal fascia is distinctly angled between nervures three and four. In all cases of difficulty the presence in *trivia* of the lower discocellular nervure of the hind-wing will form a reliable specific character.

This small form occurs over a wide area in western Asia and thence eastwards to Baluchistan and Afghanistan and N.W. India. In some examples from the Lebanon the markings are very delicate. The name *catapelia* was applied by Staudinger to specimens from Samarcand, in which the under surface of the hind-wings is white. The form appears to be common in Ferghana and Bokhara Pl. 9 fig. 8, 9, but I am unable to say whether it is constant in all broods. In northern Persia the hind-wings are already faintly yellowish below. In Afghanistan and Baluchistan the under surface of the hind-wings is definitely yellow, and the few examples I have examined have not been referable to *catapelia*, which has the appearance of an extreme desert modification.

Localities :—Syria : "Syria" many specimens without accurate data. Lebanon, evidently common, March to August. Palestine : Nazareth, no further data (Oxford Museum). Transjordan : Petra (British Museum). Mesopotamia : Kizil-Robat, Jebel Hamrin (River Dyala), 28 June, 1918, Fathah, 19th June. Persia : Several localities. Evidently widely distributed as far south as Shiraz (Wiltshire), and Bushire (British Museum). Baluchistan : Zhob, Quetta etc. Afghanistan : Kandahar (type). Bokhara : (mostly *catapelia*), Hissar Mts., Kudera, Yagnob (ex Gr.-Gr.). Turkestan : (mostly *catapelia*), Samarcand, Syr Darya etc. Many specimens without adequate data. Evidently widely distributed. India : N.W. Frontier, Miranshah, 3000–4000 ft., October–April (British Museum). Punjab, Jamrood,

Attock, 2nd May, Campbellpore, 4th Nov., 23rd March, 25th May, 6th June. Clearly a sequence of generations.

Melitaea trivia mod. ***tigris*** mod. n. Pl. 9 fig. 3.

Fore-wing ♂ 13–17 mm., ♀ 16–20 mm.

Many specimens of *trivia robertsi* from Afghanistan are not distinguishable from Syrian examples, although not infrequently the discal spots on the upper surface are somewhat exaggerated. Farther east in Chitral a striking modification occurs to which I give the name *tigris*.

This is an insect of the same small size as *robertsi*, but the upper surface shows a brighter shade of orange. The black markings are relatively heavy on both wings, particularly the discal series which is often very conspicuous, while the submarginal macules are only slightly lunulate. In most specimens some yellowish areas are present in the cell of the fore-wing and as a fascia more or less developed behind the discal spots. The under surface is less distinctive. The ground-colour of the hind-wings and of the tips of the fore-wings is very pale.

This modification shows a remarkable approach to the facies of *M. lutko* Evans which flies with it in the district. This butterfly is usually a good deal larger, and it may be further distinguished from *tigris* by the heavy black suffusion from the base and along the inner margin of the hind-wing. The marginal internervular dots are also very conspicuous on both surfaces.

Localities :—" Chitral " many specimens, July/August, also a few May/June; Drosh, Chitral, May 1901; Murree and Malakand, no further data.

The type is in the British Museum.

The following forms of *Melitaea trivia* have been described and named :—

aabaca *M. didyma aabaca* Fruhstorfer, 1917, *Soc. Ent.* **32** : 19. Loc. Castille—Spain. A sparsely marked form near *dalmatina* and *deserticola*. Belter states that the type is a specimen of *trivia* collected by Korb in Anatolia. Described from females only.

ardens *M. trivia* ab. *ardens* Erfurth, 1923, *Z. Österr. ent. Ver.* **8** : 56. Loc. Aust. Inf. The marginal lunules behind the outer margin and the discal spots are absent. An aberrational form.

catapelia *M. trivia* var. *catapelia* Stgr., 1886, *Stettin. ent. Ztg* **47** : 231. Loc. Samarcand. With weak black spots and the under surface ground-colour nearly white. See p. 266.

catapeloides *M. trivia catapelioides* Stauder, 1918, *Z. wiss. InsectenB.* **14** : 57. Loc. southern Italy. Not so pale as *catapelia* Stgr. and intermediate between it and the type. See p. 266.

caucasi *M. trivia* race *caucasi* Verity, 1922, *Ent. Rec.* **34** : 13. Loc. Caucasus. The name is later transferred to *didyma* (1929, *Ent. Rec.* **41** : 43). This is referable to *transcaucasica* Turati.

equivalens *M. trivia* Schiff. ab. *equivalens* de Sagarra, 1924, *Trab. Mus. Ci. nat. Barcelona*. Loc. Vilamajor—Catalonia (fig.).

hoffmanni *M. didyma* ab. *hoffmanni* Skala, 1908, *Ent. Z. Guben* **21** : 268. Nom. n. pro *radiata* Skala 1907 *nec* Aigner 1906. Referable to *trivia* cf. Skala, 1912, *Verh. Nat. Ver. Brunn* **50** : 109.

ignasiti *M. trivia* rassa *ignasiti* de Sagarra, 1926, *Butll. Inst. Catalana Hist. nat.* (2) **6** : 131. Loc. Montseny—Catalonia. See p. 266.

interrupta *M. trivia interrupta* Skala, 1907, *Ent. Z. Guben* **20** : 311. On the under surface of the hind-wings the basal red fascia is broken into small spots. Described in *didyma* and recorded also in *trivia* and *cinxia*.

latemarginata *M. trivia* ab. *latemarginata* Grund, 1913, *Int. ent. Z.* **7** : 128. Loc. N. Croatia. The black marginal border is very wide and on the hind-wings the lunules are entire.

lathon *M. trivia lathon* Fruhstorfer, 1917, *Arch. Naturg.* **82** (A) (2) : 13. Loc. Velebit—Bosnia. Very large with heavy black markings and a dark tone of ground-colour.

melanina *M. trivia* ab. *melanina* Grund, 1913, *Int. ent. Z.* **7** : 128. Loc. ?. The fore-wings strongly blackened, the hind-wings also black along the anterior border. The name is preoccupied by *M. phoebe* var. *melanina* Bonaparte 1831.

mercea *M. trivia mercea* De Niceville, *in litt.* ?. Reference given by Evans in 1912, *J. Bombay nat. Hist. Soc.* **21** : 1008.

nana *M. trivia* var. *nana* Stgr. 1871, *Cat.* (Ed. 2) : 18. Loc. Turkey etc. Reference to figures of Esper and Hübner. A very small dwarf form. Described as " *nana* " only.

nigrofasciata *M. trivia* forma *nigrofasciata* Gusic, 1922, *N. Beitr. syst. InsectenK.* **2** : 96. Loc. Vienna. The black lunules which form the proximal border of the orange submarginal fascia on the under surface of the hind-wing are exaggerated and joined into a continuous band.

ornata *M. trivia* ab. *ornata* Grund, 1913, *Int. ent. Z.* **7** : 128. Loc. ?. The pale marginal lunules are almost white and contrast strongly with the ground-colour.

pseudodidyma *M. trivia* var. *pseudodidyma* Rebel, 1905, *Ann. k.k. Hofmus. Wien* **20** : 194. Loc. Asia Minor—Erdschias Dagh. Very near *catapelia* but the under surface remains yellow. See p. 266.

radiata *M. didyma* ab. *radiata* Skala, 1907, *Ent. Z. Guben* **20** : 310 *nec radiata* Aigner 1906. See *hoffmanni* Skala nom. n. Should be referred to *trivia* fide Skala, 1912, *Verh. Naturf. Ver. Brunn* **50** : 47.

robertsi *M. robertsi* Butler, 1880, *Proc. zool. Soc.* **1880** : 406 (fig.). Loc. Baluchistan. A pale form with reduced black markings, the under surface yellow. See p. 266.

striata *M. trivia* forma *striata* Gusic, 1922, *N. Beitr. syst. InsectenK.* **2** : 96. Loc. Baden—Vienna. On the under surface of the hind-wings the discal macules are elongated into streaks which cross the discal field. Preoccupied by *M. didyma striata* Skala 1907.

syriaca *M. trivia* var. *syriaca* Rebel, 1905, *Ann. k.k. Hofmus. Wien* **20** : 194. Loc. Beirut and Haifa. Very small and pale. See p. 266.

tigris *M. didyma tigris* Higgins, form n., see p. 268.

variegata *M. trivia* ab. *variegata* Grund, 1913, *Int. ent. Z.* **7** : 128. A female aberrational form. The pale ochre fore-wings are much darker brownish-red near the margins.

23. ***MELITAEA YUENTY*** Ob. Pl. 9 fig. 10 ♂. Map 4, p. 185.

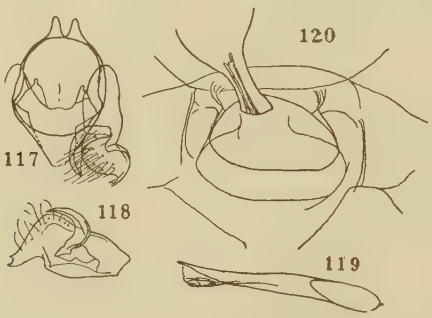
Mel. yuenty Oberthur, 1886, *Études Ent.* **11** : 17, Pl. 2. Loc. Thibet, Ta-tsien-lu.

Fore-wing 18–20 mm.

This well-known butterfly is of great interest on account of its many anomalous characters (see p. 191). The body is remarkably slender and the lower discocellular nervure of the

hind-wings is always developed; frequently the cell is completely closed. The wing markings do not closely resemble those of any other species, which is very unusual in this group. A full description is scarcely needed. The complete and regular markings and, on the under surface of the hind-wings, the wide orange transverse bands and symmetrical marginal crescents will make confusion impossible. In the specimen figured the black spots on the upper surface are not strongly developed. Not uncommonly they tend to fuse into bands across the disc and at the outer margin of the wing. The sexes are similar, although as a rule the black markings are less extensive in the female.

The male genitalia are shown in fig. 117. The whole structure is small and compact. The conical tegumen is rather long and relatively large. The ringwall shows a shallow penis-groove on each side of which is a well-developed condyle. The saccus is reduced but prominent and deeply notched. The clasp (fig. 118) is short and strong with a well-marked tuberculated area below which the short posterior process ends in a pair of sharp teeth. The harpe, which carries no teeth, is very thick and strong and directed backwards. The penis (fig. 119) is slender, tapering posteriorly, the ostium gaping. The



Figs. 117–120.—*Melitaea yuenty* Oberthur. 117. Male genitalia, dorsal view. Szechwan; 118. Clasp, lateral view; 119. Penis, lateral view; 120. Female genitalia, dorsal view.

ostium fold is large but there is no obvious keel or morula. In the structure of the penis and in the short ringwall *yuenty* mostly resembles *trivia* but the very prominent condyle recalls *cinxia* and its allies.

The female genitalia (fig. 120) closely resemble those of *didyma*. The cone is low, the bursa small and oval.

The male fore legs are small, but four tarsal elements can usually be distinguished.

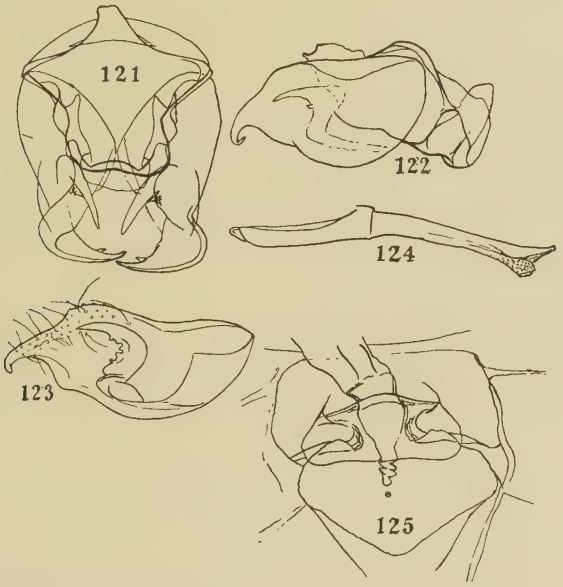
Localities :—The butterfly is confined to the mountainous districts of Yunnan and Sze-chuan in western China. In this comparatively small area it appears to be common. Watkins states that it flies from May until the end of July at elevations of 4400 to 11,000 ft. (1927, *Ann. Mag. nat. Hist.* (9) **19** : 316). Yunnan : various localities recorded by Watkins (*loc. cit.*) in north-west of the province. The specimens are said to be slightly smaller than those from Sze-chuan. Sze-chuan : many localities in the south-western part of the province on the edge of the Tibetan highlands. Leech gives the following names :—Huang-mu-chang; Wa-shan; Wa-ssu-kow; Chia-kow-ho; Chow-pin-sa; Chia-ting-fu; Ta-chien-lu. A majority of specimens in European collections bear this last locality name, which probably indicates a wide district. In the Oberthur collection specimens are recorded in addition from Siao-lou and Tse-kou.

24. ***MELITAEA LUTKO*** Evans. Pl. 9 fig. 5 ♂. Distribution Map 5.

Mel. robertsi lutko Evans, 1932, *Indian Butterflies* (Ed. 2) : 185. Loc. Chitral.

Exp. alar. ♂ 34–40 mm., ♀ 36–46 mm.

The markings of this insect are very similar to those of *trivia tigris* and *dodgsoni*. In the latter case there is really a remarkable approach of two species which are certainly not very closely allied. On the upper surface the ground-colour is rather yellowish-orange, with the marginal internervular dots strongly marked. The anterior spots of the discal series of the fore-wing are enlarged to form a prominent bar, immediately behind which some yellowish macules may be present. A post-discal series indicated by two costal spots is rarely more complete. On the hind-wing the black basal suffusion is striking and usually fills the cell and extends along the inner margin nearly as far as the anal angle. The discal spots are well developed. The under surface of the hind-wing is distinctive.



FIGS. 121–125.—*Melitaea lutko* Evans. 121. Male genitalia, dorsal view. Chitral; 122. Inferior and lateral view, to show structure of saccus; 123. Clasp, lateral view. Chitral; 124. Penis, lateral view; 125. Female genitalia, lateral view. Chitral.

The black discal spots are placed as a rule near the basal orange fascia, and the black marks immediately distal to them are strongly V-shaped, the apex of the angle pointing inwards. There is no orange mark in cellule 1b.

The female usually is a little larger than the male, but the markings are not different. I have seen a few specimens in which the upper surface was strongly melanic.

The male genitalia (fig. 121) show several unusual characters. The saccus is much produced and forms a remarkable structure resembling that of *trivia*. There is, as a rule, a central pouch or invagination from the base of the ringwall, and the inferior lip of the saccus is rolled forward below it. This character, which stamps *lutko* as an isolated form, is specially figured (fig. 122) by displaying the genitalia from below. The size and shape of the saccus are not constant. The tegumen is narrower and more conical than usual, the ringwall short but definitely grooved for the penis, and the condyles are long. The clasp (fig. 123) is stout and posteriorly it tapers rapidly to a slender process, curved sharply

inwards. The harpe is strong, nearly vertical, of moderate length, and deeply notched along the concavity to form three or four strong teeth. The penis (fig. 124) is slender and terminates in an apex. The ostium folds and the morula are developed, and the whole structure recalls *cinxia*. The female genitalia (fig. 125) show a short antrum and small but well-marked auricles. The bacillus is not visible (two preparations). An obvious approach to *cinxia* is seen in the exposed ostium bursae and the large lozenge-shaped scutum.

This interesting butterfly is anomalous in several respects. Not only the wing-marking but also the genitalia in both sexes present features of the *didyma* group. In the male these characters include the narrow and conical tegumen, the grooved ringwall and the shape of the clasps. In the female the general structure suggests a similar relationship. On the other hand, *cinxia* is recalled by the penis structure, the long harpe and the well-formed condyle of the male, and the open ostium and definite scutum of the female organs. The butterfly seems to be intermediate between *didyma* and *cinxia*, with characters about equally divided between the two. The insect occurs along the north-west frontier from Murree in the Punjab to Chitral. Farther south it appears again in the Quetta district of Baluchistan. It is therefore restricted to an area upon the extreme limit of the Palearctic region, but the full range has yet to be determined, and nothing is known of the possible distribution between Chitral and Quetta. The forms which occur in the two centres can usually be distinguished by external characters. That of Baluchistan, described below, is pale and suggests a desert modification. The typical form from Chitral is relatively dark, and more heavily marked, as is usual in Melitaeid butterflies from hilly districts. The genitalia of the two forms differ in a marked way. Judging by this alone the forms might be given specific rank, but I have dealt with them as subspecies, although such differentiation is unusual in a relatively small area. In this respect there is an obvious analogy between *lutko* and the European *athalia*, which also presents two major types of male genitalia, each of which has a characteristic distribution.

Most of the specimens seen were taken in the early spring, but the record from Gawar on 7 August suggests that at least two broods occur in some localities.

The male holotype is in the British Museum.

Localities :—Chitral, May/June 9000 ft. (type in Brit. Mus.), Evans; many specimens labelled " Chitral " without further data; Keon Nullah, 7000 ft., June; Drosh, 6000–10,000 ft., 1 May; Murree, no further data; Malakand, no further data.

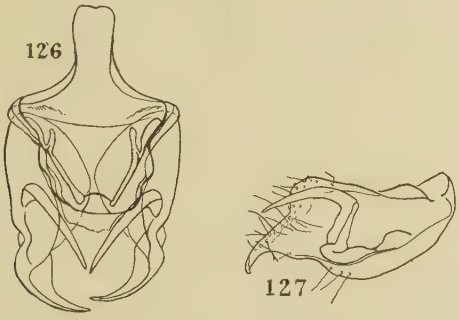
Melitaea lutko mimetica Higgins. Pl. 4 fig. 8 ♂; 9 fig. 4 ♀.

M. lukto [sic] *mimetica* Higgins, 1940, *Entomologist* **73** : 52.
Mel. robertsi robertsi Butl. Evans, 1932, *Indian Butterflies* (Ed. 2) : 185 (sed *robertsi* Butl. = *trivia* W.V. forma). Loc. Baluchistan.

This insect agrees in size with typical *lutko* from Chitral, from which it can usually be distinguished by the brighter and more reddish tone of the ground-colour of the upper surface and by the reduced black markings. On the fore-wings the yellowish macules behind the discal spots are often prominent and frequently developed into a fascia which extends right across the wing. The post-discal spots are rarely present, and the disc of the hind-wing is unmarked in most cases, while the black basal suffusion is much reduced. The sexes are similar. In the specimen figured (Brit. Mus. type) the black markings on the upper surface are rather more complete than usual. On the under surface the proximal orange fascia of the hind-wings is much broken and absent in cellule 1c, while the black

V-marks are only distinctly angled in cellules 2, 3 and 4. It is shown on Plate 4 to assist easy comparison with *dodgsoni*.

There are three principal features in which the male genitalia (fig. 126) differ from those of typical *lutko*. The posterior process of the clasp seen from above is less acutely curved and is more slender (fig. 127). The harpe is longer, more slender and without teeth, and the saccus is more simple, produced forwards, but the rolled inferior lip is not obvious (five preparations). In the figure the difference appears very marked. The development of the saccus is rather variable, and the contrast is not so great in all specimens.



Figs. 126–127.—*Melitaea lutko mimetica* Higgins. 126. Male genitalia, dorsal view. Baluchistan; 127. Clasp, lateral view.

Localities :—Baluchistan : Khojak, 11/20 April, 6500 ft. (Evans) male holotype, British Museum; Zaghun, 13 April, 6000 ft. (Evans); Gawar, 7 August (Evans); Sheik Wazil, 26 April; Ziarat Road, 20 April, female allotype, British Museum; Urak, 26 May; Quetta, 15 April.

25. *MELITAEA ROMANOVI* Groum-Gr. Pl. 9 fig. 6 ♂, 12 ♀. Distribution Map 5.

Mel. romanovi Groum-Grshmailo, 1891, *Hor. Soc. ent. Ross.* **25** : 454. Loc. Amdo; Hoang-Ho River.

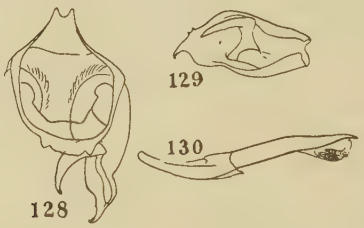
Fore-wing 22 mm.

This rare but well-known insect can scarcely be confused with any other species, and only the shortest description is needed. On the upper surface the ground-colour of both wings is creamy yellow. The black markings are heavy and the usual tawny ground-colour only appears at the bases, along the outer margin and at the apex of the cell. On the under surface the contrast of colours is less unusual. On the hind-wing the basal fascia is much broken up. Small central dots are present in the macules of the submarginal fascia. In the female the black markings on the upper surface are much lighter and the pale tawny ground-colour more extensive. A row of yellow macules appears behind the discal spots.

The male genitalia (fig. 128) are small, the saccus narrow and produced forwards, the ringwall tapering posteriorly. The tegumen is shallow, with small scaphial elements, recalling *cinxia*. The clasp (fig. 129) is constricted posteriorly, and terminates in a short and slender process. In lateral view two small spines are visible on the superior border. The long and curved harpe carries no teeth. The slender penis (fig. 130) tapers gradually to an apex, and an oval morula appears in the ample ostium folds. There is a marked approach to *lutko* Evans and in some respects to *trivia* W.V., especially in the form of the penis.

There is no doubt that *lutko* and *romanovi* are closely allied. It is probable that they may be regarded as divergent forms derived from a common ancestor, and representing an ancient fauna.

Distribution. This is only vaguely known, as specimens of the butterfly are so rare. The insect appears to extend from the Amdo northwards through the Kentei Mountains to the Altai, where it appears in a small form described



Figs. 128–130.—*Melitaea romanovi* Groum. 128. Male genitalia, dorsal view. Amdo; 129. Clasp, lateral view. Amdo; 130. Penis, lateral view. Amdo.

below. The typical specimens and three paratypes are preserved in the British Museum. They are relatively large and brightly marked. The original labels are still present, but the name Chuan-Che replaces the more familiar Hoang-Ho. According to Staudinger (1892, *Deuts. ent. Z. Iris* **5** : 323) the original specimens were caught in the Dscharchar Mountains, and those from the Kentei were taken at the end of June in a high Alpine meadow.

Melitaea romanovi mod. ***puella*** mod. n. Pl. 9 fig. 11 ♀.

Fore-wing 19 mm.

There are two pairs of this small form from the Changai Mountains in the British Museum. The markings are rather insignificant, and the contrast of colours much less marked than in the typical specimens from the Amdo. In the female the upper surface is sandy orange with only a suggestion of the yellow macules behind the discal spots. The resemblance to a form of *didyma* or *trivia* is strong, but black pupils are present in the submarginal macules of the hind-wings.

The presence of this modification suggests that the species may be sensitive to climate. The form in markings and small size might be expected to occur in a dry locality, while the typical *romanovi* with the strong contrast in colours would by analogy appear in moist surroundings. I have seen no specimens from localities other than the Amdo and the Changai Mountains.

Localities :—Amdo : Moudjik, Hoang-Ho Valley, 21 July 1890 (Brit. Mus.); ex coll. Gr.-Gr., type ♂ and ♀ and 3 paratypes. Kentei Mountains : *fide* Staudinger, 1892, *Deuts. ent. Z. Iris* **5** : 323. Altai Mountains : *fide* Seitz, 1909, *Grossschmett. Erde* **1** : 220. Changai Mountains : no further data, 2 ♂♂ and 2 ♀♀ (Brit. Mus.) mod. *puella* types.

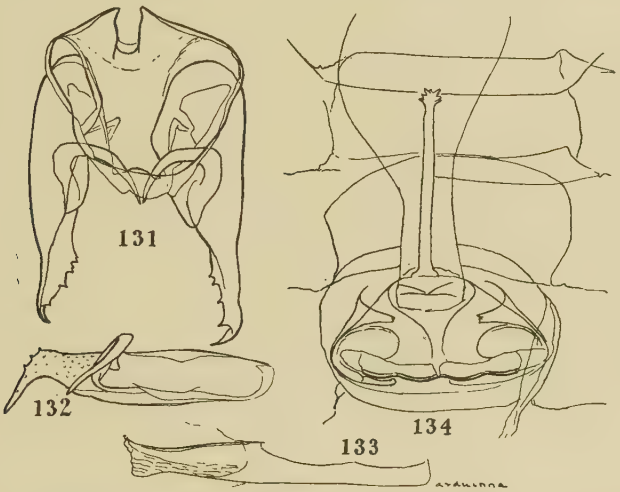
26. ***MELITAEA ARDUINNA*** Esper. Pl. 8 fig. 9 ♂. Distribution Map 5.

Pap. arduinna Esper, 1784, *Europ. Schmett.* **2** (2) : 169, Pl. LXXXVII. Loc. South Russia, Kamyschenka (?Kamyschin) on the Volga.

Mel. arduinna var. *uralensis* Eversmann, 1844, *Fauna Uralensis* : 3. Loc. Southern Urals. *Idem in* Fischer, 1851, *Entomog. Ross.* **5** : 77, Pl. X.

Fore-wings 19–21 mm.

On the upper surface the ground-colour is orange-yellow. On the fore-wing the usual marks are present in the cell, and the discal series is complete. The orange submarginal lunules, heavily outlined proximally by a black fascia, form the most prominent feature of the wing. On the hind-wing there is a black basal suffusion which does not extend to the body groove. The black discal spots are usually complete, and the post-discal fascia is divided by the nervures into regular macules of which three or four contain black points. The marginal black border is rather wide, and as a rule the submarginal lunules are also bordered proximally by a firm black fascia to correspond with that on the fore-wing. On the under surface the markings are not distinctive on the fore-wing. On the hind-wing the orange submarginal fascia contains several black points, and it is continued as an orange macule on the inner margin in cellules 1a and 1b. The latter character provides a convenient distinction from *phoebe* and *collina*, and in addition to this the greater regularity of



Figs. 131–134.—*Melitaea arduinna* Esper. 131. Male genitalia, dorsal view. Syria; 132. Clasp, lateral view; 133. Penis, lateral view; 134. Female genitalia, dorsal view. Fergana.

the markings and the constant presence of black points in cellules 2 and 3 of the hind-wing should serve to identify *arduinna*. In many female specimens the ground-colour on the under surface of the hind-wings is white (*uralensis* Eversm.).

The male genitalia (fig. 131) resemble those of *cinxia* in the wide tegumen. The ring-wall is short and grooved and there is a marked condyle. The penis-groove is closed above by a narrow horseshoe-shaped piece of chitin, an unusual structure which is not easy to see. The clasps (fig. 132) are long and narrow, the posterior process curved downwards, its superior border provided with a series of small spines. The rather slender harpe is strongly curved. Seen from above, it is directed almost horizontally inwards across the ringwall. The penis (fig. 133) is stout and straight, with a well-developed apex. A very small ostium-keel is present, and the ostium folds are ample, although it is difficult to distinguish a morula. In the female genitalia (fig. 134) the bacillus is very long and is single. It extends to the anterior border of the seventh sternite and supports a large oval bursa copulatrix. The scutum is scarcely developed, and the whole structure corresponds closely with a typical example of the *didyma* group.

Distribution etc. This interesting insect is clearly related to *cinxia*, but it shows in the male genitalia a divergence towards *didyma* in the grooved ringwall. This tendency is more marked in the female organs, which show complete *didyma* characters. It may be classed as an anomalous and transitional species between the two main groups. *M. arduinna* appears to be most common in hilly districts at a moderate elevation. I have seen several specimens marked 3000 ft. and no doubt the optimum altitude varies with the latitude. It appears to be widely distributed over the whole central Asiatic region, but in the west it is rare and the limits of its range are at present indefinite. It occurs throughout Asia Minor in the form *rhodopensis*, and appears in Europe in eastern Bulgaria. Existing records from Rumania need confirmation, but it may probably be found all round the Black Sea. I have seen no specimens from the Ukraine. In southern Russia is found the small typical form described above. It occurs as a scarce and local insect as far north as the 50 degree of north latitude and towards the east in the Urals perhaps up to the 55 degree. This form is not strictly geographical, and very similar specimens are to be found in other districts in cool localities at a considerable elevation among mountains. In central Asia it flies from the Kirghiz steppe to the western slopes of the Thian-Shan and the Boro-Choro Mountains. The most easterly locality I know is the Kok-Su pass. In Bokhara and Persia it seems to be common, and often modified by diminution of the black pattern to the large forms *evanescens* and *fulminans*. In Persia it is most often recorded from the high mountains of the north, but it certainly occurs also in the south and is probably generally distributed.

Localities :—South Russia : Volga (*fide* Esper); South Urals (Brit. Mus.). Thian-Shan : "Fort Narine"; Kok-Su pass; Boro-Choro Mountains. Alai Mountains : Brit. Mus., no further data. Tarbagatai Mountains : Brit. Mus., no further data. Sarafschan : Sary-Ob, 7000–9000 ft., Brit. Mus. Syria : Shah Deresy. Asia Minor : Kedos (Brit. Mus.). Afghanistan : Paghman (Paghman = 17 miles west of Cabul) 8000 ft. (*C. Musters*).

Melitaea arduinna mod. ***rhodopensis*** Freyer.

Papilio (*Melitaea*) *rhodopensis* Freyer, 1836, *N. Beit. SchmettK.* **3** : 3, Pl. 193 fig. 1. Loc. Turkey-in- Europe.

Fore-wing 24–27 mm.

This is a large and handsome form of which I have seen few examples. The ground-colour on the upper surface is rich tawny orange, and all the black markings are very complete. One of Freyer's original specimens is in the British Museum. I have seen a short series at Sofia taken near Burgas in eastern Rumelia, perhaps the locality of Freyer's type. It is not confined to Europe, and I have seen several examples from Asia Minor referable to this form. This and other modifications of *arduinna* are unstable, although well characterised in some examples. Intermediate forms are numerous, and only the more extreme specimens can be placed with accuracy. In a species so sensitive to environment it seems reasonable to treat the named forms as *formae tempestatis*.

The female is slightly larger than the male, the ground-colour is paler and the black markings heavier.

After Freyer's description of *rhodopensis* was published the insect was not found again in Europe for nearly a century and its existence was doubted by

many. Nothing could be better than the figure in the *Neuere Beiträge zur Schmetterlingskunde.*

Localities :—" Turkey-in-Europe " (Freyer); near Burgas, Bulgaria (Sofia museum); ? Rumania, Tultscha (Mann, requires confirmation); Asia Minor, Hadjin, Turkey; others with indefinite localities.

Melitaea arduinna mod. ***evanescens*** Stgr. Pl. 8 fig. 3 ♂.

Mel. arduinna var. *evanescens* Staudinger, 1886, *Stettin. ent. Ztg* **47** : 231. Loc. North Persia; Samarcand.

Fore-wing 22–25 mm.

Most western Asiatic specimens are referable to this modification.

It is a form of moderate or large size, the ground-colour on the upper surface bright fulvous. The black markings tend to become obsolete, particularly the post-discal marks on the fore-wings and the dark scales along the nervures, which are prominent in the typical form. On the under surface the black markings are somewhat lighter.

There is a series in the British Museum from Persia which is fairly constant, but a majority of specimens are rather nondescript, somewhere between *evanescens* and typical *arduinna*. In the other direction this modification grades insensibly into that described by Staudinger as *fulminans*.

Distribution. I have seen *evanescens* from a large number of localities, and it is probably the most widely distributed form. Specimens in which the ground-colour is reddish-orange and the markings show some tendency towards reduction, and consequently cannot be placed as typical *arduinna* or as *rhodopensis*, may be placed here.

Localities :—Asia Minor : no further data, several specimens. Syria : Akbes. (Brit. Mus.). Persia : Shahkuh; Erivan; Dixful Mountains (South Persia). Turkestan : Margilan etc. (*fide* Staudinger); others without full data.

Melitaea arduinna mod. ***fulminans*** Stgr. Pl. 8 fig. 10 ♀.

Mel. arduinna aberr. *fulminans* Staudinger, 1886, *Stettin. ent. Ztg* **47** : 230. Loc. Samarcand.

Fore-wing 25–28 mm.

This is the largest form of *arduinna*. The ground-colour of the wings on the upper surface is pale sandy orange or yellowish. The most striking character is the reduction of the black pattern on the upper surface. In some specimens the usual markings are scarcely indicated, but one or two black points are always present in the submarginal fascia of the hind-wings. The pale ground-colour and scanty black markings suggest modification by a desert climate.

Localities :—Samarcand; Juldus; Baldschuan; North Persia as a rare aberration (*fide* Staudinger).

Melitaea arduinna mod. ***avinovi*** Shelj. Pl. 8 fig. 4 ♂.

Mel. arduinna Esp. *avinovi* (subsp. n.) Sheljuzhko, 1914, *Deuts. ent. Z. Iris*, **26** : 20, text-fig. Loc. Ishkashim, Pamirs.

Fore-wing ♂ 15–18 mm.; ♀ 18·5–19·5 mm. (*teste* Sheljuzhko).

In this small form the fore-wings are more elongated. On the upper surface the discal spots of the fore-wings are usually large and confluent. Ground-colour rather pale, and variegated by the presence of yellow macules at the base and in the post-discal area where they form a distinct fascia across the wing. These yellow macules are seen also on the disc

of the hind-wing and on the under surface of the fore-wing. The author notes that these spots are really conspicuous only in certain specimens.

There is a single specimen in the British Museum, a paratype presented by Sheljuzhko, which is illustrated here.

Locality :—Recorded only from Ishkashim, in the south-western Pamirs.

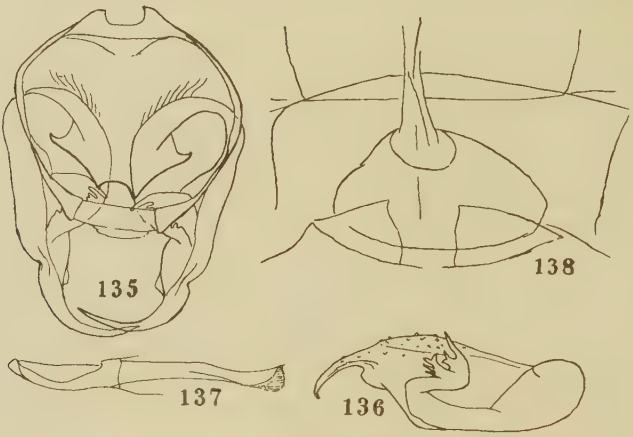
27. ***MELITAEA AGAR*** Ob. Pl. 8 fig. 5 ♂; 11 ♀. Distribution Map 5.

Mel. agar Oberthur, 1886, *Études d'Entomologie* **11** : 18, Pl. V. Loc. Ta-tsien-lu.

Fore-wing ♂ 18–20 mm.; ♀ 18–23 mm.

The typical form of this species is so well known that a full description is scarcely necessary.

The rich, tawny upper surface of the male, with the wide black marginal border and the heavy macular pattern are unmistakable. On the hind-wings the orange submarginal



Figs. 135–138.—*Melitaea agar* Oberthur. 135. Male genitalia, dorsal view. Szechuan; 136. Clasp, lateral view; 137. Penis, lateral view; 138. Female genitalia, dorsal view.

fascia shows the conspicuous series of black dots which is so characteristic of the *cinxia* group. The female is often strongly melanic, and the markings consequently indistinct. It is probable that this is really the typical form. On the under surface the black markings of the fore-wings are complete upon the paler yellow ground-colour. The hind-wings are pale yellow, and in the typical form a black point is present in the centre of each macule of the orange submarginal fascia. The discal series of small dots is usually represented only by a single mark in cellule 7, and the disc of the wing therefore shows a wide unmarked yellow area.

Genitalia. The male genitalia (fig. 135) are very distinct. The ringwall is narrow, and there is a definite penis-groove which is accentuated by the lingula which terminates anteriorly in a large condyle, while the notch of the saccus is wide. The clasp (fig. 136) terminates in a long and slender process, curved inwards, and below this is a prominent boss. The harpe is wide and flat like an elkhorn, with many long teeth. It lies in a horizontal position and is directed inwards. The penis (fig. 137) is slender and tapering posteriorly, the ostium folds well marked. A small ostium-keel can be seen, but the morula is not obvious. The female genitalia (fig. 138) recall *didyma*, with a single weak bacillus and a narrow scutum.

The extremely dark specimens so common at Ta-tsien-lu have been named ab. ♀ *obtecta* by Seitz (1909, *Macrolep. World* **1** : 220).

Distribution. *M. agar* is a divergent form. The general facies recalls *didyma*, but the presence of the black dots in the submarginal fascia of the hind-wing indicates the correct relationship. This is confirmed by the structure of the male genitalia, although the penis has no characteristic apex. The shape of the harpe and clasper is most unusual, and shows some approach to species of the *fergana* group, and particularly to *lunulata* Stgr. The female genitalia are unlike those of any other species, but the single bacillus and general structure suggest an approach to *didyma*.

It is a butterfly of the high mountains. Leech says that in China it flies at 5000–11,000 ft. I have seen several specimens in which an elevation of 10,000 ft. has been noted. The known range of the typical form is restricted to the Chinese province of Szechwan. A somewhat modified form described below occurs in the neighbouring mountains of eastern Tibet. Three paratypes (♂♂♀) are now in the British Museum.

Localities :—Western China : Ta-tsien-lu. (This label probably includes a wide district, *teste* Bang-Haas, 1927, *Horae Macrolep.* : xxiv.) Mou-pin; Wa-ssu-kow; Ni-tou; etc. (Leech).

Melitaea agar mod. ***baileyi*** Watkins. Pl. 8 figs. 6 ♂, 12 ♀.

M. didyma wardi Watkins, 1927, *Ann. Mag. nat. Hist.* (9) **19** : 316. Loc. North-west Yunnan.
M. didyma baileyi Watkins, *loc. cit.* : 512, nom n. pro *wardi* Watkins 1927 *nec M. palla* ab. *wardi* Ob. 1914.

Fore-wing ♂ 15–18 mm., ♀ 17–18 mm.

This is rather smaller than the typical form, and on the upper surface of the male the black markings are reduced. This is particularly obvious on the hind-wings where the usual submarginal black points rarely appear. On the under surface of the fore-wing the black markings in the cell are reproduced as above. The discal series is also complete but external to this, indications of the post-median and submarginal macules are present only at the apex of the wing. On the under surface of the hind-wings the transverse fasciae are wider than in the typical form, which reduces the width of the space between them. The black points are rarely visible in the submarginal fascia. The female is less melanic in *baileyi*. The orange ground-colour is clearly visible on the upper surface of the hind-wings, and in some specimens of the fore-wing also. The under surface is marked as in the male. The basal orange fascia is conspicuously wide, and some indications of black points are often present in the submarginal fascia. The small black spots of the discal series are usually present and complete, which is not the case with female *agar* of the typical form.

Localities :—Kingdon Ward says that *baileyi* occurs in Yunnan. The actual specimens were taken in the Tibetan province of Kham and they are marked "S.E. Thibet". The following localities are not marked upon an ordinary map. They are to be found along the Tsangpo River, in exploring which the specimens were taken. S.E. Tibet : Kham : Phe, 9 July 1913, 10,000 ft. (29′ 30″ N. and 94′ 50″ E.) ; Dokar, 10 Aug. 1913, 10,000 ft. ; Chegun Valley, 6 Sept. 1913, 14,000 ft.

Note. The typical specimens of *wardi* ♂ and ♀ are in the British Museum. They are from the " Tsang-Po " without further data. There is also a ♀ specimen from Phe labelled as the typical specimen of *baileyi*. I assume that the examples from the Tsang-Po are the true type and allotype.

b. ***cinxia*** group.

1. *Melitaea cinxia* Linn
2. *Melitaea minerva* Stgr.
3. *Melitaea pallas* Stgr.
4. *Melitaea turanica* Ersch.
5. *Melitaea diamina* Lang.
6. *Melitaea arcesia* Brem.

Group characters. The six species included in this group show two distinct types of wing-pattern, exemplified by *cinxia* and *diamina*. At one time I considered a division into two separate groups, but the insects are all so closely allied that separation would be misleading. On the whole the characters of the genitalia are rather negative, and consist chiefly of simplicity of structure and the absence of the marked features which distinguish the other species groups. In most cases both genitalia and wing-markings are easily recognised. The shape of the tegumen and of the penis show also a resemblance to *phoebe*, which is obviously very closely allied, and in some species (*diamina*) the wing-markings recall *Mellicta*. It is not improbable that *cinxia* represents an ancient group from which *didyma* and *phoebe* have diverged.

In the perfect insect the markings are variable. A distinctive character is the presence of a round reddish spot in each macule of the submarginal band on the under surface of the hind-wing. Each spot has frequently a black centre which is visible on the upper surface in some species and which provides a striking character. The male fore legs are usually much atrophied. The palpi (fig. 144) are ascending, slender, the terminal joint about as long as the basal joint. About half the middle joint is visible beyond the head.

The male genitalia are of medium size. The ringwall is short, the condyles developed and sometimes conspicuous. The tegumen is short and wide, the scaphial elements just visible on each side. The clasp is long and narrow, the posterior process arising from the superior border. It is curved downwards and inwards and is usually provided with one or more small teeth. The harpe is noticeably strong, without teeth, and directed vertically backwards. The penis terminates in a prominent apex, which is a distinctive feature already noticed by Suschkin, and the morula is often pronounced. The structure of the female genitalia is complicated. The cone is well developed, the bacillus bifid or forked for about half its length. In some species (*cinxia*) it is a striking object, in others so imperfectly developed that it can scarcely be identified. The auricles are large and prominent, distally forming a bold shelf. Often the ostium bursae appears between them. The scutum is well developed, sometimes divided by a suture into two lateral plates.

In the case of *cinxia* and *diamina* two broods are produced annually in suitable localities. It is possible that other species are also double-brooded. The egg is well known only in the case of *cinxia*. It is sculptured with 17 or 18 grooves which extend from apex to base. Larvae of *cinxia* and *diamina* are known. The spines are short, resembling those of *athalia*. The food-plants in both species are said to be *Plantago* (*cinxia* especially on *P. lanceolata*), *Veronica*, *Melampyrum* and other low plants.

Distribution. (Distribution Maps 1, 6.) While the *cinxia* group is distributed over the whole Palearctic region, it presents no specialised forms in Europe. In view of the development of several Alpine species in central Asia, it is perhaps surprising that no specialised forms are found in the European Alps. The species are confined to the more temperate regions or they occur in the Alpine zone of high mountains. In temperate Europe and Asia from the Atlantic to the Pacific is found *diamina* (*dictynna*) with an area of distribution only equalled by *E. aurinia*. In the extreme east, in Corea, China and Japan this species is modified as a paler and larger form, *regama*, a well-defined subspecies, and the only vicariant form in this group. The second European

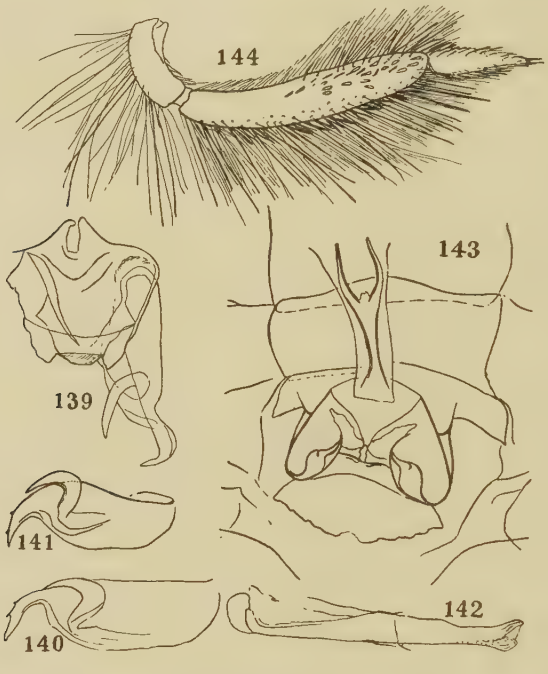
species, *cinxia*, appears to extend slightly less far towards the east, although it certainly occurs on the Amur at Tchita and nearly reaches the Arctic circle at Verchojansk. The geographical variation of this butterfly is almost negligible. These two insects are the only representatives of the group over an enormous area. Both are common and generally distributed and the number of individuals must be very great. In the mountains of central Asia the European forms are absent, but three different species appear as alpine insects, extending from the Ala-tau along the western Thian-Shan to the Alai Mountains. Here occur *turanica*, *pallas*, and *minerva*, the latter extending also to Chitral across the Pamirs. These insects appear to be abundant in their flight places, and from the number of individuals they must constitute a characteristic element in the alpine fauna of these regions. Variation of climate and the obvious isolation of different colonies in different mountain systems will probably explain the presence of great local variation, especially in the case of *minerva*. At high altitudes farther east in the Tibetan region, including the Himalaya and the mountains of Kham and Szechuan, a single species near *diamina* is extensively distributed. A whole series of forms appears, including *arcesia*, *jezabel*, *sindura*, *balbita* etc., which I have dealt with as a single specific group. Variation in this butterfly is very marked in the Himalaya but in the north of the distribution area the much more stable name form *arcesia* occurs from the Amdo to the Altai Mountains and northwards far beyond Lake Baical. No doubt the variability in the south is due again to isolation on the great mountain masses of the Himalaya. The wide distribution of a single group in Tibet and the Himalaya to the exclusion of all others is most unusual. Nowhere else in the Palearctic region is there a large area or a considerable mountain range which provides only a single group. In view of these evidences of antiquity, the occurrence in the north of only two species, each with an enormous distribution and showing relatively little variation, is surprising. These two species show the two distinct types of wing-pattern which occur in Asia, that of *cinxia* representative of the western forms found in the Thian-Shan and Alai Mountains, while *diamina* belongs to the *arcesia* series which occurs farther east in Tibet and which does not extend in the west beyond Kashmir. Although so closely allied, the separation in central Asia into western and eastern groups must have an important significance with which is connected the origin of the European species. Finally the North American *acastus* Edw. and related species are very closely allied to the *cinxia* group. Excluding the totally distinct Euphydryad series, these are the only Melitaeine butterflies in America which show an obvious relationship to any of the Palearctic forms. Although their wing-pattern is almost identical with *diamina* and *cinxia*, the American species, so far as I have examined them, must be placed in a separate group, on account of the strongly differentiated genitalia. In this respect they approach closest to *phoebe*.

28. ***MELITAEA CINXIA*** Linn. Pl. 10 fig. 9 ♀. Distribution Map 6.

Pap. cinxia Linné, 1758, *Syst. Nat.* (Ed. X) : 480. No locality given.
Pap. pilosellae Rottemberg, 1775, *Naturforscher* **6** : 5. Loc. Paris.
Pap. delia Schiffermuller, 1775, *Verz. Schmett. Wien. Gegend* : 179. Loc. Vienna.
Pap. cinxia var. (a) *fulla* Quensel, 1791, *K. Vet. Ac. N. Handl.* **12** : 278. Loc. Sweden.
(An aberration but the name is valid and it is used specifically by Dalman in 1816, *Pap. Suecica* : 77).
Pap. abacus Retzius, 1783, *Gen. Spec. Insect* : 32. (The name is available but the work is of doubtful nomenclatorial validity.)

Fore-wing 17–25 mm.

In the male the ground-colour of the upper surface is rather pale yellowish-orange. The markings are linear and complete, the usual transverse series of lunules continuous and the nervures also outlined with black. On the fore-wing the discal series is not as a rule especially prominent, but the marginal internervular dots are well developed. On the hind-wings the black markings are often wider and more suffused. There is a black suffusion extending from the base along cellule 1c, but the inner margin is yellow. The macules of the submarginal fascia from 1c to 5 show a central rounded black spot. The macule in 1c is placed more distally out of line with the others. On the under surface the ground-colour of the fore-wing is again orange-yellow. The markings are mostly obsolete, but as a rule the black discal series can be seen. The tip of the fore-wing and two or three of the submarginal macules near the costa are lemon yellow, and in this area the marginal



Figs. 139–144.—*Melitaea cinxia* L. 139. Male genitalia, dorsal view. Piedmont; 140. Clasp, lateral view. Bulgaria; 141. Clasp, lateral view. Hami, Sinkiang; 142. Penis, lateral view. Bulgaria; 143. Female genitalia, dorsal view; 144. Male palp.

spots are prominent. On the hind-wing the ground-colour is pale yellow like the tip of the fore-wing. At the base the spots are black and the orange fascia, which is somewhat irregular, is represented by a large macule in cellule 1c and a smaller macule is often present in 1b. The submarginal orange fascia is divided into macules by the nervures which are outlined by black scales as they cross. Each macule encloses a round reddish spot which bears a black pupil to correspond with the black spots on the upper surface. The marginal spots are distinct and regular.

The female is usually slightly larger than the male, which it may otherwise resemble. The ground-colour of the upper surface is often less bright and the black markings more diffuse with a faint greenish tinge. In many specimens from high mountains the ground-colour is very pale, nearly white in worn examples. The green suffusion is strongly developed in specimens from some localities in south-western Asia (see mod. *amardea*).

The Genitalia. In the male the ringwall is nearly flat and the condyle long but slender (fig. 139). The clasp (fig. 140) is of medium length and in lateral view the upper and lower borders are nearly parallel. The posterior process is curved evenly downwards, and turns sharply inwards near the apex. Two small dorsal spines are present. Viewed laterally the process is slender and of even width in European specimens, but in some forms from the Far East (fig. 141) it is stout at the base and tapers gradually to a point. The harpe is thick and strong, without teeth. The penis (fig. 142) is nearly straight, with a large olecranon. It terminates in a blunt apex, below which the ostium-keel appears. The ostium folds are developed, but there is no obvious morula, which is unusual in the group. The female genitalia (fig. 143) are very distinct. The cone is symmetrical, about as long as it is wide. The scutum is well defined, usually somewhat lozenge-shaped. The bacillus is highly developed, bifid for about half its length like a two-pronged fork. The bursa appears to be oval. The whole structure is so characteristic that it cannot be confused with that of any other species.

The early stages are well known. The egg is marked with fine grooves from the summit to the base (*cf.* South, 1906, *Brit. Butt.* **1** : 101). The larva is dark with a red head.

The butterfly emerges in late spring or early summer; later, at high elevations. In many localities in the warmer parts of central and southern Europe a partial second brood appears at the end of the summer.

Variation. There is a general tendency to local variation on the lines which appear in many species, but in my opinion these modifications must be placed as *formae tempestatis*. Individual variation may be extreme, and a large number of aberrational forms have been described, characterised by the exaggeration or diminution of some of the black markings. An attempt to define geographical variation is disappointing, and the more extensive the material available for study, the less convincing are the forms usually recognised. The typical form of *cinxia* was specified by Verity as the " small, pale northern one " (1916, *Ent. Rec.* **28** : 128), and this may be accepted. In this article Verity distinguished the northern form from the larger and brighter southern European race. Meyer-Dür (*Verz. Schmett. Schweiz* : 128) had already noticed that southern specimens (*australis* Vrty) from Macedonia and Asia Minor were paler and less heavily marked than most of the northern specimens with which he was familiar. The distinction is only constant in the most general sense, and it is without geographical significance, as dark specimens are found in Greece and in the Pyrenees. Fruhstorfer and others have suggested separation of the German race from that of the extreme north and the name *pilosellae* Rott. is available for the former, which is said to be larger. I cannot satisfy myself that any distinction can be made. Certainly many British *cinxia* are small, but others are quite as large as German specimens. Oberthur, working with very large series, stated (1909, *Ét. Lép. comp.* **3** : 234) that he found no geographical races defined in western Europe, and it seems doubtful whether the local forms described by several writers have any geographical significance. The insect does vary considerably in size, and in a given locality this is more constant than the markings. As a rule the largest specimens occur in the lowlands. These are found from Spain to the Issyk-kul, with very little variation. Examples from most northern localities are often small (for example, from the Isle of Wight). The small size is also very obvious in mountain specimens both in Europe and in Asia. Many specimens from the plains of northern Europe and from the high Alps are really identical, which suggests that the small size has the character of a climatic modification. I have grouped such examples under the name *tschujaca*. Specimens of the second brood are also small, with the

ground-colour paler and the cross-markings weaker than in first-brood examples. The name *phaira* has been given to these specimens by Fruhstorfer, but seems scarcely required. There is an obvious approach to *australis* Vrty, in the pale ground-colour and fine markings, which is not surprising.

Distribution. Although its distribution is enormous, *cinxia* shows a stability both in structure and in facies which is very unusual in Melitaeid butterflies. In Europe it is one of the most generally distributed of Melitaeid species, found from sea-level to an altitude of 6000 ft., while in Asia on the Demavend it ascends to 7000 ft. (*teste* Groum). It flies from Spain to the Amur, and occurs as far north as the Isle of Wight, Scandinavia up to the 60 deg. of north latitude, and in Russia at least as far north as Petrograd. In the south it is common along the northern shores of the Mediterranean, and it has been taken in Greece south of the Gulf of Corinth and in Algeria. In Asia it is found in Asia Minor, Syria and in Persia, but principally as a mountain insect. Farther north it is generally distributed across the western Siberian plain. In central Asia it is common in the north, extending as far south as the western Thian-Shan (Tekkes Valley and " Naryn "). The species has not been recorded with certainty from Ferghana. Farther east it appears once more as a mountain butterfly, and it is found commonly in the Altai, Kentei and other ranges as far as the Amur river, and passes north of this certainly to Verchojansk. The specimens of eastern Asia differ little or not at all from those of the European Alps.

Determination should not be difficult, but there may be confusion with *arduinna*. In the latter on the upper surface the markings are less regular as a rule, the orbicular mark of the fore-wing is much larger and the black marginal border of both wings wider. On the under surface *arduinna* shows a fine black marginal line on the hind-wing, and there is an orange wash along the inner margin, continuous with the orange submarginal fascia. The macules of the latter are differently formed in the two insects.

Localities :—A representative list of localities is given here for convenience. Europe : generally distributed, but scarcer north of the 55 degree. In England now found only in the Isle of Wight. Occurs in southern Scandinavia and in Finland. In the south it is found in Sicily, northern and central Spain, and is doubtfully reported from Andalusia. North Africa : in Morocco and Algeria. Scarce and local, known only from a few localities in the mountains. Western Asia : generally distributed in southern Russia; in Asia Minor, Syria and Persia, chiefly in the mountains. Central Asia : only in the north in western Siberia, and in northern Turkestan. I have seen no specimens from Ferghana. Eastern Asia : common in most of the great mountain ranges. I have specimens from the western Thian-Shan, Altai, Kentei, Changai and Sajan ranges. Not south of Mongolia (Urumchi and Hami). In the north probably widely distributed but specimens only available from Transbaicalia and Shigansk.

Melitaea cinxia mod. ***clarissa*** Stgr. Pl. 10 fig. 5 ♂.

M. cinxia var. *clarissa* Staudinger, 1901, *Cat.* (Ed. 3) : 29. Loc. Asia Minor.
M. cinxia australis Verity, 1916, *Ent. Rec.* **27** : 128. Loc. Florence
M. cinxia narbonensis Fruhstorfer, 1917, *Soc. Ent.* **32** : 19. Loc. Riviera.
M. cinxia sicula Ragusa, 1920, *Nat. Sicil.* **23** : 149. Loc. Sicily.
M. cinxia deva Hemming, 1934, *Stylops* **3** : 98. nom. n. pro *M. cinxia sicula* Ragusa 1920 *nec athalia sicula* Trti. 1915.
M. cinxia castiliana Turati, 1920, *Nat. Sicil.* **23** : 224. Loc. Castille—Spain.
M. cinxia carpetana Verity, 1929, *Ent. Rec.* **41** : 132. nom. n. pro *M. cinxia castiliana* Trti. 1920 *nec aurinia castillana* Oberth. 1909.

This resembles typical *cinxia* in size. On the upper surface the ground-colour of the wings is brighter and more tawny than is usual in northern specimens. The black markings are finer with little suffusion. This is particularly noticeable in the female. On the under surface the markings are not distinctive.

This form occurs in warm southern districts from Spain to the Ural Mountains. In central and southern France individual specimens occur, but it is not the predominant form. In the mountainous districts of Asia the specimens are often small, and grade imperceptibly into the little *amardea* described below. They are larger in Europe, where the species is found on the plain. Specimens of the small summer brood in all localities show a tendency to the *clarissa* facies. It is probable that not only heat but a dry atmosphere is needed for the development of this modification, and in most districts where *clarissa* occurs less modified forms also appear. The form is well characterised only in individual specimens or colonies, and the distribution strongly suggests a climatic modification. It is most doubtful in my opinion whether the various named races from Asia, Italy and Spain can be distinguished. It is probable that *australis* Verity from Florence (Plate 10 fig. 6 paratype ♂) is a true synonym of *clarissa*, and a good series from Sicily (*deva* Hemm.) appears to me indistinguishable. Specimens from Castille (*carpetana* Vrty) are not, perhaps, quite so pale, but another name scarcely seems to be necessary. Several forms have been named intermediate between *clarissa* and ordinary *cinxia*.

Localities :—I have seen *clarissa* more or less well developed from Asia Minor, Greece, Turkey, Crimea, " Russia " and the Urals (these very fine, quite as good as the finest Italian specimens), central and southern Italy, central and southern France and Spain. In eastern Asia pale specimens also occur (Changai Mountains etc.) but these are often small and grade rather into *tschujaca*. Careful distinction must be made between the first and second broods, as in many localities these show marked difference.

Melitaea cinxia mod. ***tschujaca*** Seitz. Pl. 10 fig. 1, 2, ♂♀.

M. cinxia tschujaca Seitz, 1909, *Macrolep. Erde* **1** : 215. Loc. Altai Mts.
M. cinxia arelatia Fruhstorfer, 1910, *Ent. Z. Stuttgart* **24** : 144. Loc. Dauphine at 7000 ft.

Fore-wing 16–18 mm.

This is the usual mountain form, which is slightly smaller than typical specimens. Examples from the Altai are not really remarkable in any way. They resemble many small examples from the plains of Europe, and others from high altitudes in the European Alps are quite similar, often rather dark. In the mountainous regions of Asia Minor the insect is also small and frequently paler, combining the characters of *tschujaca* with those of *clarissa*. This may be due to the drier climate, and runs into *amardea* described below. Female specimens of this form from the European Alps are nearly always very pale, with a greenish suffusion, and the wings may show no trace of orange. Such females (Pl. 10 fig. 7), which occur also not uncommonly in the Isle of Wight and in other northern localities, may be referred to *pallida* Tutt. They are found also in Asia Minor and in Persia in very beautiful examples, but in eastern Asia and in northern Africa the females are similar to the males. The smallest examples I have seen (Pl. 10 fig. 11) are from Hami (Aksu) in Mongolia. In these the characters of *tschujaca* are exaggerated, but unfortunately they are without full data. In the form *arelatia* Fruhst. the black pigment on the upper surface is brownish as if the scales were imperfectly formed, which gives a faded appearance. In north Piedmont I have taken single examples of this form, at

about 6000 ft. and in some localities it evidently predominates. I look upon such specimens as *tschujaca* in which the scale pigment is especially modified by extreme altitude.

Melitaea cinxia mod. ***amardea*** Groum-Gr. Pl. 10 fig. 4 ♂, 10 ♀.

M. cinxia var. *amardea* Groum-Grshmailo, 1895, *Hor. Soc. ent. Ross.* **26** : 291. Loc. North Persia; Mt. Demavend.

In this very small form, described from Mount Demavend, the ground-colour of the upper surface is clear orange yellow, and all the markings are fine and delicate. The typical specimens and several paratypes (see figures) from Groum's collection are preserved in the British Museum. The combination of characters is sufficiently striking to require a name, but as the specimens were taken at an elevation of 7000 ft. in a hot and dry district, a small pale form would be expected. On Mount Shahkuh and in Luristan *cinxia* appears in a similar but slightly larger form. The females, of which there are three in the British Museum (Pl. 10 fig. 8), are greenish-grey and show strong *pallida* characters, as is usual in mountainous districts. They are analogous to *M. didyma* ♀-form *cinerea*, and doubtless show modification by similar conditions. I think it is possible that the *amardea* types are specimens of the second generation, and the form is not found everywhere in Persia. Similar male specimens occur elsewhere (Pl. 10 fig. 3) in Europe and Asia, mostly as second-brood specimens. The females often tend towards the form *deficiens* Cabeau. This modification shows the *australis* features in small specimens, and is strictly *forma tempestatis*. It is not possible to attribute a geographical or subspecific significance to these characters.

Melitaea cinxia atlantis Le Cerf. Pl. 10 fig. 12 ♂.

Mel. cinxia atlantis Le Cerf, 1928, *Bull. Soc. ent. Fr.* **1923** : 224. Loc. Grand Atlas—Morocco.
Mel. cinxia algerica Oberthur, 1914, *Ét. Lép. comp.* **10** : fig. 2339. Loc. Sebdou.
Mel. cinxia eupompe Hemming, 1933, *Entomologist* **66** : 276. nom. n. pro *algerica* Oberth. 1914 *nec aetherie algerica* Heyne 1893.

This insect corresponds with ordinary *cinxia* in size. On the upper surface the ground-colour is pale yellow-ochre. There is often a suffusion of darker yellow across the disc and along the outer margin of the fore-wing. On the under surface the fore-wing is pale orange-yellow, the apex and outer margin creamy white. The usual black pattern is strongly marked. The hind-wing is creamy white, the orange fasciae very pale and mixed with the ground-colour. The bleached and pallid upper surface of this form is very striking. It appears to be restricted to the Grand Atlas, and there is a short series in the British Museum, but knowledge of the distribution is too vague to allow a guess of the correct systematic status. The specimens seen are slightly worn and may be a little faded, which would exaggerate their pale colour. In the middle Atlas *cinxia* is known from Timhadit and elsewhere (Ellison) and in Algeria from Sebdou. These specimens are not remarkable, except that on the under surface of the fore-wing the discal spots are prominent as in *atlantis*. This feature appears constantly in African *cinxia*, and should probably be taken as a subspecific character. In my opinion the Algerian *eupompe* Hemm. should be united with *atlantis* as a single subspecies, but the latter may represent an extreme temperature form. It is difficult to explain the abnormal *atlantis* colouring, when the undistinguished *eupompe* exists so near, which does not even show marked *clarissa* characters.

Localities :—Morocco : Grand Atlas, Djebel Tachdirt, June/3 July, 100 m.–3500 m.; Arround, 30 May, 2500 m. Altogether 4 ♂ and 4 ♀ paratypes in the British Museum. The following refer to the form *eupompe* Hemm. Middle Atlas : Timhadit, 19 April (*Ellison*), Anosseur, 3 May (*Ellison*), Ait Olman, 22 April (*Ellison*). Algeria : Sebdou, May (*Powell*), a small form.

Note.—*M. cinxia* var. *heynei* Ruhl 1893 : 384. This form was described from one pair sent from the Alai Mountains. It is said to represent a striking variety. On the upper surface the black wing-margin is wide and regular, the fore-wings wider than in *cinxia*. The submarginal lunules are deeper and better formed on both surfaces. This description appears to me to refer to a form of *arduinna*, and there is no record at present of true *cinxia* from the Alai.

The following forms of *Melitaea cinxia* have been described and named :—

algirica *M. cinxia algirica* Oberth., 1914, *Ét. Lép. comp.* **10** : 101. Loc. Sebdou —Algeria. (The name appears in the index and against fig. 2339.) A small form with very distinct discal macules on both surfaces of the fore-wing. The name is preoccupied by *aetherie algirica* Ruhl 1893. Probably very near *atlantis*. See *eupompe* Hemming. See p. 286.

amardea *M. cinxia* var. *amardea* Grum-Grshmailo, 1895, *Hor. Soc. ent. Ross.* **29** : 291. Loc. Demavend—Elburz Mountains. Very small and pale specimens, possibly second generation. See p. 286.

arelatia *M. cinxia arelatia* Fruhstorfer, 1910, *Ent. Z. Stuttgart* **24** : 144. Loc. Dauphine—La Grave. Very small, with rather pale dull yellow ground-colour.

atlantis *M. cinxia atlantis* Le Cerf, 1923, *Bull. Soc. ent. Fr.* **1923** : 224. Loc. Grand Atlas. Pale ochre-yellow. The discal spots of the fore-wings are enlarged. See p. 286.

australis *M. cinxia australis* Verity, 1916, *Ent. Rec.* **28** : 128. Loc. Florence. A large and rather pale form with the black pattern reduced. Verity states that *narbonensis* Fruhst. is a synonym. (1928, *Ent. Rec.* **40** : 144.) See p. 284.

bifasciata *M. cinxia bifasciata* Hartig, 1924, *Ent. Rundsch.* **41** : 42. Loc. S. Tirol. A conspicuous double row of black macules across the disc of the hind-wings. Described from one female specimen.

brenthis *M. cinxia* ab. *brenthis* Reuss, 1921, *Ent. Z. Guben* **15** : 5. Loc. Mark Brandenburg. The fore-wings suffused with black on the upper surface, leaving two small orange costal macules and a small submarginal series.

carpetana *M. cinxia carpetana* Verity, 1929, *Ent. Rec.* **41** : 132. Nom. n. pro *c. castiliana* Trti. 1920 *nec artemis castillana* Oberth. 1909.

castiliana *M. cinxia castiliana* Turati, 1920, *Nat. Sicil.* **23** : 224. Loc. Castile—Spain. A pale form with a fine black pattern.

cernyi *M. cinxia* L. ab. *cernyi* Jonkl, 1908, *Casopis* **5** : 96. (Diagnosis in Čech not translated.)

clarissa *M. cinxia* var. *clarissa* Stgr. 1901, *Cat.* (Ed. 3) : 29. Loc. Syria etc. Pale ground-colour and fine black markings. See p. 284.

deficiens *M. cinxia* ab. *deficiens* Cabeau, 1922, *Rev. Mens. Soc. ent. Namur* **22** : 45. Loc. Theux. On the upper surface the post-median black line is obliterated on all wings. (Very common female form in oriental specimens.)

deva *M. cinxia* f. *deva* Hemming, 1934, *Stylops* **3** : 98. nom. n. pro *cinxia* f. *sicula* Ragusa 1920 *nec sicula* Turati 1915.

diniensis *M. cinxia* var. *diniensis* Wheeler, 1903, *Butt. Switz.* : 85. Loc. Digne. The submarginal spots of the hind-wings are absent. See also *impunctata* Osthelder.

eupompe *M. cinxia eupompe* Hemming, 1933, *Entomologist* **66** : 276. Nom. n. pro *cinxia algirica* Ob. 1914 *nec algirica* Heyne 1893.

expuncta *M. cinxia* L. ab. *expuncta* Cabeau, 1926, *Lambillionea* **26** : 75. Loc. Virton. A specimen of the ab. *deficiens* Cab. but on the under surface of the hind-wings the white discal fascia has no black spots within it.

fulla *Pap. cinxia* var. (a) *fulla* Quensel, 1701, *Act. Holm.* **1791** : 279 (fig.). Loc. Sweden. An aberrant specimen in which the usual black pattern of the fore-wings is nearly absent.

gergovia *M. cinxia gergovia* Fruhstorfer, 1918, *Soc. Ent.* **33** : 43. Loc. Auvergne. A small form with greenish dusting especially the fore-wings.

graciliens *M. cinxia* L. ab. *graciliens* Pionneau, 1932, *Misc. ent.* **40** : 27. Loc. France. The discal and post-discal black lines greatly reduced on the upper surface of the fore-wings. (Two specimens.)

heynei *M. cinxia* var. *heynei* Ruhl, 1893, *Paläarct. Grossschmett.* : 384. On the upper surface the submarginal lunules are very well formed. Almost certainly referable to *arduinna* Esp. See p. 287.

horvathi *M. cinxia* ab. ♀ *horvathi* Abafi-Aigner, 1906, *Ent. Z. Guben* **19** : 208. Loc. Hungary. The whole upper surface clouded with rusty black. A submarginal row of orange macules of normal colour. See also ab. *brenthis* Reuss.

impunctata *M. cinxia* mod. *impunctata* Osthelder, 1925, *Schmett. Sudbayerns* **1** : 85. Loc. S. Bavaria. The submarginal points on the hind-wings tend to disappear. See also *c.* ab. *diniensis* Wheeler.

interligata *M. cinxia* L. ab. *interligata* Cabeau, 1926, *Lambillionea* **26** : 91. Loc. ?. On the upper surface of the fore-wing the black macules of the discal series are united.

interrupta *M. cinxia* ab. *interrupta* Skala, 1907, *Ent. Z. Guben* **20** : 311. Loc. Nikolsburg ?. On the under surface of the hind-wings the basal red fascia is broken into small spots. Recorded also in *trivia* and in *didyma*.

jubilaris *M. cinxia* L. ab. *jubilaris* Cabeau, 1930, *Lambillionea* **30** : 122. Loc. Belgium. The black discal macules on the under surface of the hind-wings enlarged and partly fused together. *Cf.* ab. *nigrofasciata* Horhammer, *collina* ab. *duplicata* Pfeiffer etc.

karajevi *M. cinxia karajevi* Obratsov, 1936, *Festschrift E. Strand* **1** : 639. Loc. S. Russia (Cherson). Upper surface rather dark. Ground-colour of the hind-wings below is chalk-white instead of yellowish. Cf. *sacaria* Frhst.

leucophana *M. cinxia leucophana* Cabeau, 1919, *Rev. Mens. Soc. ent. Namur* **19** : 61. Loc. Virton. On both surfaces the ground-colour is very pale yellowish or whitish. See also *M. athalia leucophana* Cabeau 1912—a similar modification.

mocsaryi *M. cinxia* ab. ♂ *mocsaryi* Abafi-Aigner, 1906, *Ent. Z. Guben* **19** : 208. Loc. Hungary. A male aberrational form in which the markings are enlarged and fused, mostly united into a large central patch.

narbonensis *M. cinxia narbonensis* Fruhstorfer, 1917, *Soc. Ent.* **32** : 19. Loc. Riviera. The description refers only to the females which are yellowish and not suffused, with the usual black markings diminished, especially in the post-discal area.

obscurior *M. cinxia* ab. *obscurior* Staudinger, Seitz, 1907, *Grossschm. Erde* **1** : 215 (fig.). On the upper surface the black pattern is so extended that the ground-colour scarcely appears. Loc. not cited.

obsoleta *M. cinxia* ab. *obsoleta* Tutt, 1896, *British Butt.* : 310. The black markings partly obsolete. Loc. not cited. Tutt reports also *M. aurinia obsoleta loc. cit.* : 305.

ocelliformis *M. cinxia* f. *ocelliformis* Reuss, 1921, *Ent. Z. Guben* **15** : 4. Loc. Mark Brandenburg, bred specimen. On the upper surface rather dark, with partial or complete ocellus formation in the submarginal fascia.

pallida *M. cinxia* ab. *pallida* Tutt, 1896, *Brit. Butt.* : 311. A name for those females with a whitish ground-colour and extended black markings. See also *pallidior* Ob. Loc. The name presumably refers to British specimens.

pallidior *M. cinxia pallidior* Oberthur, 1909, *Ét. Lép. comp.* **3** : 234. Loc. Alpes. Name for female specimens in which the ground-colour is pale fawn and the black pattern extended. See also *pallida* Tutt.

phaira *M. cinxia* forma *phaira* Fruhstorfer, 1918, *Soc. Ent.* **33** : 15. Loc. Geneva, southern France and Hungary. A name for the second generation. This is paler and the cross markings are less thick.

pseudoclarissa *M. cinxia* L. raca *pseudoclarissa* de Sagarra, 1932, *Butl. Inst. Catal. Hist. nat.* **10** : 114. Very near *clarissa* Stgr. but the black pigment said to be more intense.

sacaria *M. cinxia sacaria* Fruhstorfer, 1917, *Arch. Naturg.* **82** (A) (2) : 15. Loc. Saratow. The black pattern reduced, the females usually pale. Transitional to *clarissa* Stgr.

semiobscura *M. cinxia* L. ab. *semiobscura* Pionneau, 1932, *Misc. ent.* **40** : 27. The hind-wings on the upper surface widely suffused with black. Transitional to *obscurior* Stgr.

sicula *M. cinxia sicula* Ragusa, 1920, *Nat. Sicil.* **23** : 149. Ground-colour pale, on the fore-wings the black markings tend to disappear towards the outer margin. See *c. deva* Hemm.

subtusmarcata *M. cinxia* f. *subtusmarcata* Reuss 1921, *Ent. Z. Guben* **15** : 4. Loc. Mark Brandenburg, 2% of specimens bred. On both surfaces the black bands are exaggerated.

suffusa *M. cinxia* ab. *suffusa* Tutt, 1896, *Brit. Butt.* : 310. Loc. not cited. The black pattern is much extended.

terracina *M. cinxia terracina* Fruhstorfer, 1917, *Arch. Naturg.* **82** (A) (2) : 14. Loc. Krain—Bosnia. A large pale form with narrow black markings, the females greyish-green.

transversa *M. cinxia* f. *transversa* Reuss, 1921, *Ent. Z. Guben* **15** : 4. Loc. Mark Brandenburg, bred specimen. On the upper surface the black discal band is heavy and isolated.

tschujaca *M. cinxia tschujaca* Seitz, 1909, *Grossschmett. Erde* **1** : 215 (Aug.). Loc. Altai Mountains. A small and dark form. See p. 285.

uhryki *M. cinxia* ab. *uhryki* Abafi-Aigner, 1906, *Ent. Z. Guben* **19** : 208. Loc. Budapesth. The fore-wings on the upper surface are almost free from pattern, but the hind-wings very dark at the base.

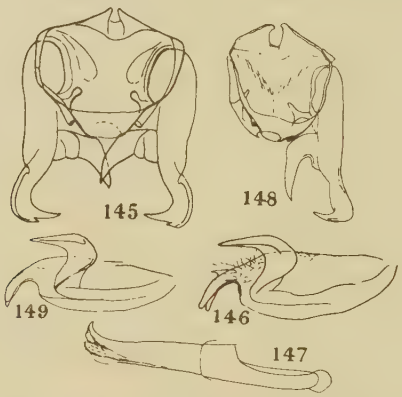
wittei *M. cinxia* ab. *wittei* Geest. *in* Osthelder, 1925, *Schmett. Sudbayerns* **1** : 85. Description not traced.

29. ***MELITAEA MINERVA*** Stgr. Pl. 11 fig. 4 ♂. Map 6, p. 187.

Mel. minerva Staudinger, 1881, *Stettin. ent. Ztg* **42** : 289. Loc. Ala-tau (specified in 1886).
Mel. minerva var. *palamedes*, Grum-Grshmailo, 1890, *in* Romanoff *Mém. Lép.* **4** : 436. Loc. Alai Mountains.—Goultcha.

Fore-wing 16–23 mm.

On the upper surface the ground-colour is orange-yellow. The black markings are clear and regular, and the nervures are marked with black scales beyond the cell. On the fore-wing the usual striae are present in the discoidal cell and at the base. The median series is complete, the macules almost, or quite, continuous, and strongly angled basally in cellules 3 and 4. The post-median series consists of lunules more delicately drawn, which form with the darkened veins a series of rounded or quadrangular orange marks. The submarginal series is not clearly lunular. It appears to be fused with the marginal line to make a wide black terminal band in which the orange marginal crescents stand out clearly.



FIGS. 145–149.—*Melitaea minerva* Staudinger. 145. Male genitalia, dorsal view. Alai Mts.; 146. Clasp, lateral view. Alai Mts.; 147. Penis, lateral view. Pamir Mts.; 148. Male genitalia, dorsal view. Shandur Pass (*balbina* Tytler); 149. Clasp, lateral view. Shandur Pass (*balbina* Tytler).

On the hind-wing the basal markings are indistinct on account of the wide black suffusion along the inner margin, which extends into the cell and reaches the anal angle. In the posterior half of the wing there are usually one or two black marks, which represent the discal series, and the post-discal series is also indicated particularly near the anal angle. The black submarginal lunules are well formed and fused into a continuous series.

The under surface of the fore-wing is pale yellow at the tip beyond the submarginal lunules. The black markings are much more delicate than on the upper surface, but the post-median series is often present. The ground-colour of the hind-wing is pale yellow or whitish. A small orange macule is present at the base of cellule 2 and sometimes also in the discoidal cell. The usual basal and submarginal orange fasciae are present, the latter composed of a series of orange semilunar macules, bordered proximally with black, and in the centre of each a round, reddish spot.

In the female the ground-colour on the upper surface is somewhat paler, but the markings are heavier, and there is a moderate amount of greyish suffusion especially on the fore-wing. The under surface resembles that of the male.

The male genitalia are short and wide (fig. 145). The oval clasp is relatively large (fig. 146). A small spine is present at the base of the strong posterior process, which is terminally bifid and is bent sharply inwards. The harpe is characteristic, very large and

strong, directed posteriorly. It is wide at the base, and is without teeth. The penis (fig. 147) is slender, the apex strongly upturned. The ostium fold is very delicate, but there is a large morula.

The female genitalia have not been examined.

The distinction from the closely similar *pallas* Stgr. will be dealt with when the latter insect is considered.

This is a widely distributed species, which occurs from the Issyk-kul in the north to the Pamirs and Chitral in the south. In the original description it is probable that *pallas* and *minerva* were confused, but at a later date (1886, *Stettin. ent. Ztg* **47** : 235) Staudinger specified as typical *minerva* examples from the Ala-Tau, of which the description is clear and where *pallas* does not occur. Examples from northern localities, and these are scarce in English collections, must be regarded as typical (fig. 4). They are perhaps slightly smaller and the colouring is not so intense as in those from the Alai described as *palamedes* by Grum (fig. 5 ♂, 11 ♀). The collection of the British Museum contains a good series of paratypes of this form, said to have been taken at about 6000 ft. The relatively large size and rich colouring are obvious, but the difference is probably the result of luxuriant development in a favourable locality. In the absence of good series from other localities it is impossible to say whether the form is racially distinct. In such an unstable species it is not possible to name every degree of variation. In the Alai Mountains and through the Pamirs to Chitral are found smaller forms described below. These small insects are often paler, the difference in facies between the extremes is astonishing, and differentiation is well marked. The forms comprise a unit which may be regarded as a polytypic species or supraspecies.

Localities :—Ala-tau, no further data (L.G.H.) ? typical *minerva*; Issyk-kul, no further data (L.G.H.); Tian-Shan, no further data (L.G.H.); Alai Mountains, no further data (L.G.H.); also from Guttscha, Pamirs. A good series in the Brit. Mus. from coll. Gr.-Gr. All these are marked paratypes of *palamedes* Gr.

Melitaea minerva sultanensis Stgr. Pl. 11 fig. 2 ♂, 8 ♀.

Mel. parthenie var. *sultanensis* Staudinger, 1886, *Stettin. ent. Ztg* **42** : 234. Loc. " Samarcand."

Fore-wing 16–19 mm.

This is a smaller insect that the typical form. On the upper surface the ground-colour of the wings is yellowish. The black markings are fine and delicate, but usually complete. On the under surface, also, the markings are less emphasised but not otherwise different. In the female the ground-colour of the fore-wing on the upper surface is sometimes nearly white with a slight greenish suffusion.

The genitalia are smaller than those of typical specimens, but I can find no other difference.

This modification flies in southern Ferghana, where it appears to be common and widely distributed. The distinction from *minerva* is one of degree only, and I have intermediate specimens from the " Thian-shan " and Issyk-kul, so it is not unlikely that *sultanensis* may be discovered in other more northern localities. It occurs in the Alai, where the much larger *palamedes* is also found, and no doubt intermediate forms are developed, although I have seen none from this district. Unfortunately I have no examples with an indication of altitude.

Localities :—Bokhara : Alai Mountains, no further data (Brit. Mus.);

Sultan-Hazret Mountains, no further data (L.G.H.). FERGHANA : Samarcand, no further data. A good series in the Brit. Mus. all marked as paratypes from Staudinger; Sarafschan, no further data (L.G.H.); Sarafschan, Sary-Ob., Brit. Mus.; "Samarcand," Kulikulan, Brit. Mus.

Melitaea minerva balba Evans. Pl. 12 fig. 10 ♂.

Mel. balbita race *balba* Evans, 1912, *J. Bombay nat. Hist. Soc.* **21** : 582. Loc. Chitral.
Mel. arcesia balba Evans, 1927, *Indian Butterflies* : 121.
Mel. minerva balba Evans, 1932, *Indian Butterflies* (Ed. 2) : 186.

Fore-wing 18–20 mm.

This insect is slightly smaller than the typical form, and about the same size as *sultanensis*. In the male the outstanding character is the brilliant foxy-red tone of the ground-colour of the upper surface. The usual black markings are well developed, and a paler point may be present on the costa near the apex of the fore-wing. On the under surface the fore-wings are usually free from markings below the discoidal cell. On the hind-wings the usual black markings and striae appear somewhat accentuated, the pattern is bright, and the contrast of colours strong. The female (Pl. 13 fig. 11) is a beautiful insect with a good deal of dark suffusion on the upper surface. There is a well-marked pale fascia posterior to the discal series, and the submarginal macules are red. I have seen several such specimens, and this form of the female is certainly very common in some localities.

Localities :—Chitral, Dok, 26 June–25 July, 1910. Altitude noted from 11,000 ft. to 14,000 ft.; Evans (*loc. cit.*) gives South Chitral, from Ashreth and Madaglasht only; the typical male specimen is in the British Museum, from Brigadier Evans' collection.

Melitaea minerva balbina Tytler. Pl. 11 fig. 3 ♂, 9 ♀.

Mel. balba balbina Tytler, 1926, *J. Bombay nat. Hist. Soc.* **31** : 583. Loc. Chitral, Shandur Pass.

Fore-wing ♂ 14–16 mm., ♀ 18 mm.

In size and in most other respects this insect resembles *sultanensis*. On the upper surface the ground-colour varies from yellow to reddish-orange. The black markings are slightly heavier and more regular. The black discal fascia is often strongly marked. On both wings the orange marginal lunules are a little larger and wider. On the hind-wings the post-discal markings frequently disappear, and in the female even the marginal lunules may be wanting. On the under surface the black markings are better defined. The female is usually a little larger than the male, and traces of black suffusion may appear on the fore-wings.

The male genitalia (figs. 148, 149) are much smaller than those of *minerva*, but otherwise the differences are slight. The harpe seems often more slender than usual (three preparations).

This form is known only from Chitral, where it appears to be common in the north (Evans). The ground-colour is variable, but the distinction from *sultanensis* is not always possible, although in series the firmer and more regular black pattern gives a different facies.

I think it is very probable that this insect, with *sultanensis* and the darker *balba*, forms with *minerva* a continuous series the transitional forms of which have not yet been described.

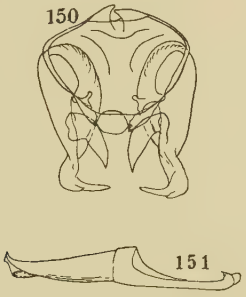
Localities :—NORTH CHITRAL : Shandur Pass, 12,200 ft., 3 July 1922 (type male, now in the Brit. Mus.). Ghizer, Gilgit, no further data (L.G.H.), July; Shahjenali Pass (L.G.H.), July.

Melitaea minerva elizabethae Avin. Pl. 11 fig. 10 ♂.

Mel. elizabethae Avinoff, 1910, *Hor. Soc. ent. Ross.* **39** : 235. Loc. South Pamirs.

This form differs from the last chiefly in the ground-colour of the upper surface which is pale yellow. The black markings are complete and delicate, except the discal series of the fore-wing, of which the four costal spots are usually enlarged. In all specimens examined the series is strongly curved basally in cellules 2 and 3, and the orbicular stigma is smaller than usual. In most specimens a complete submarginal fascia can be seen on the hind-wings, outlined by black, which shows through from beneath. The marginal lunules are wide, as in *balba* and *balbina*. On the under surface the ground-colour of the hind-wing is shining white, the orange submarginal fascia narrow with the black borders heavily marked. The female resembles the male, and in none of the specimens are the fore-wings in the least suffused.

The genitalia (figs. 150, 151) scarcely differ from those of *minerva*.



Figs. 150–151.—*Melitaea minerva elizabethae* Avinoff. 150. Male genitalia, dorsal view. Pamir Mts.; 151. Penis, lateral view.

There is a short series of this form in the British Museum, including four paratypes from Avinoff which are all labelled " South Pamir—upper reaches of the river Toguz-Bulak " in Russian script. I have two similar specimens in my collection, and no doubt they are all part of Avinoff's original series. Two specimens are marked in addition 3800 m. There is also in the British Museum a single male from the " Hindu-Kush " which may be referred to this form. The pale colour of the upper surface and the rather scanty markings of the hind-wings beneath produce a striking appearance which might occur in a dry habitat at a great altitude. It is not possible to be certain of the correct status of this form until the distribution is better known.

30. ***MELITAEA PALLAS*** Stgr. Pl. 11 fig. 6 ♂, 12 ♀. Distribution Map 6.

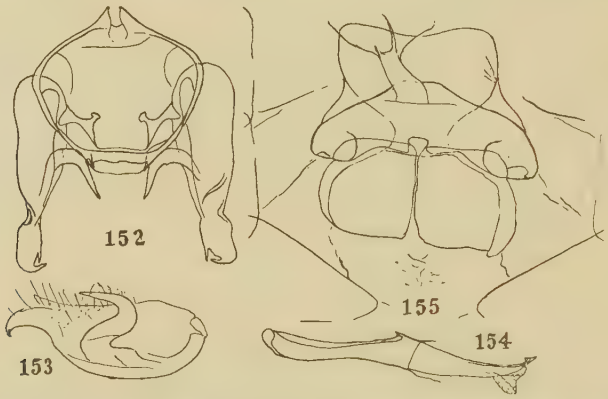
Mel. minerva var. *pallas* Staudinger, 1886, *Stettin. ent. Ztg* **42** : 235. Loc. Southern Alai Mountains.

Fore-wing ♂ 18–20 mm., ♀ 20–22 mm.

This insect resembles *minerva* Stgr. so closely that it is only necessary to point out the distinctive features. On the upper surface the tone of the ground-colour is often more fulvous (red), though this is somewhat variable. The black pattern is less regular and complete. On the fore-wing the discal series is usually emphasised but less continuous in *pallas*, being composed of clearly separated black spots. It is also commonly straighter and not quite so deeply convex basally in cellules 2 and 3. The four costal macules lie in a straight line, which is rarely the case in *minerva* forms. The post-median fascia is often absent and rarely distinct. A gleaming white spot is nearly always present on the costa

before the first marginal lunule. On the hind-wings the nervures are less completely outlined with black scales. The wide black basal suffusion often terminates in a large macule in cellule 1c, but there is little sign of the discal markings of which there are usually traces in *minerva*. On the under surface the resemblance between the two species is very close. On the fore-wing the post-discal fascia is nearly obsolete, while in *minerva* it is often represented by a complete series of small dots. There are some specimens in which the distinction is scarcely possible without dissection.

The genitalia in the male (fig. 152) resemble somewhat closely those of *cinxia*. The ringwall is short and narrow posteriorly, with a very prominent condyle. The clasp (fig. 153) is oval, with the posterior process rather stout and evenly curved from above downwards and from without inwards. At the base near the inner aspect there is a long spine, which arises from the dorsal surface and shows a wide base in profile. The harpe is moderately slender and evenly curved, without teeth. The penis (fig. 154) is nearly straight and tapers posteriorly to terminate in a beautiful upturned apex. The ostium folds are



Figs. 152–155.—*Melitaea pallas* Staudinger. 152. Male genitalia, dorsal view. "Naryn"; 153. Clasp, lateral view; 154. Penis, lateral view; 155. Female genitalia, dorsal view. "Naryn."

ample and the morula well developed. In the female (fig. 155) the genitalia are less distinctive. The cone is low and the bacillus obscure and weakly bifid (2 specimens). The scutum is large and conspicuous, divided by a suture into two equal plates. Above it the ostium bursae can be distinguished, while the bursa itself is oval.

Distribution etc. This insect seems to be confined to the mountains in the neighbourhood of Ferghana. Probably it scarcely penetrates the Pamirs. In the Alai, and perhaps elsewhere, it is associated with *minerva*, but the latter has a much more extensive distribution. The two insects are often confused and published records are therefore of little value. The most northerly specimens of *pallas* that I have seen are those from Bossogo. In these the ground-colour of the upper surface is unusually dark brownish-orange. The altitude of 12,000 ft. marked on these specimens suggests that the insect flies in the high Alpine zone.

M. pallas has also to be distinguished from *turanica* Ersch. although there is no suggestion that the two insects fly together. The latter can be separated by the bolder markings of the under surface. On the hind-wing, in particular, the relatively wide pale median band is almost unmarked, and the basal orange fascia is conspicuously narrow in cellule 2. The smaller form *turanica* mod. *asteroida* is not likely to cause confusion.

Localities :—East Turkestan : Prov. Semirechgensee, Fort Naryn; a long series from the Oberthur collection without further data ; Bossogo, June—12,000 ft. Ferghana : Namangan; Marghilan; many specimens derived from Staudinger without further data. East Pamirs : Togomshibu, July; one pair from Brigadier Evans. This locality cannot be exactly traced. It is somewhere on the road from the Kilik Pass to Kashgar, probably about lat. 38° 00″ and long. 75° 15″. Hunza : Mizgah, no further data, coll. Tytler.

31. *MELITAEA TURANICA* Ersch. Pl. 12 fig. 3 ♂, 9 ♀. Map 6.

Mel. turanica Erschoff (*athalia* ab. on plate), *in* Fedtschenko, 1874, *Reise nach Turkestan* : 47. Loc. "Samarcand."
Mel. pamira Staudinger, 1887, *Stettin. ent. Ztg* **48** : 53. Loc. Transalai or Pamir.
Mel. expressa Grum-Grshmailo, *in* Romanoff, 1887, *Mém. Lép.* **3** : 401. Loc. Touptschek, Pamirs.

Exp. alar. 34–42 mm.

In the male the ground-colour of the upper surface is rather bright tawny orange. The markings are regular and continuous, recalling *athalia* rather than *cinxia*. On the fore-wing the nervures are outlined by dusky scales, and the usual marks are present at the wing-base and in the cell. The discal row of macules is usually complete and often heavily marked. The post-discal series is often faint or absent, but the submarginal and marginal lines are conspicuous, and united by the black nervures to enclose a series of orange macules which are less crescentic than those of the related species. Not infrequently these macules are more or less obliterated by fusion of the submarginal and marginal lines. On the hind-wing there is a wide black suffusion along the inner margin, and the nervures are completely outlined by black scales. The unmarked discal field is a conspicuous feature, although in some specimens a post-discal series may be indicated. The double black border at the outer margin is prominent and encloses a series of orange lunules similar to those of the fore-wing.

On the under surface of the fore-wing the ground-colour is paler than above, the tip and marginal lunules yellowish. The marginal dots are very faint or absent. The basal and discal markings are delicately indicated. On the hind-wing the orange transverse fasciae contrast with the pale yellow ground-colour. The basal spots are black, usually confluent. The discal series of linear striae extends from nervure 4 to the costa. A fine black terminal line is present, but the terminal dots are scarcely visible.

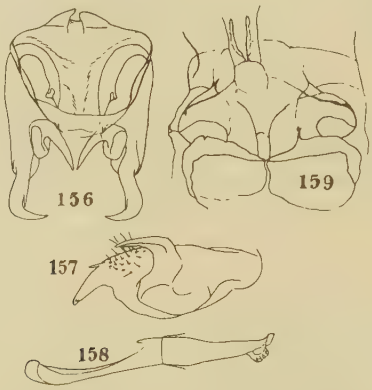
The female is slightly larger than the male, the upper surface of the fore-wings often heavily suffused with dark grey, but this is not always so. When the suffusion is marked a row of submarginal macules and two or three spots in the cell remain bright orange and with the field of the hind-wing contrast strongly with the dark ground of the fore-wing.

In the male genitalia (fig. 156) the tegumen is not distinctive. The condyles are not conspicuous, almost vertical, and scarcely overhang the slightly grooved ringwall. The clasp (fig. 157) has a stout posterior process which is bent abruptly inwards. From the superior and medial aspect of the neck of the process arises a fine spine, which is set directly into the clasp without a wide base. The harpe is of moderate size, without teeth and sharply bent proximally. The penis (fig. 158) shows the olecranon well marked. In lateral view the shaft usually diminishes in size rather abruptly towards the apex, which is strongly upturned.

In the female genitalia examined (2 specimens) the cone is low and tenuous (fig. 159), the bacillus scarcely developed, although the fork can be distinguished. The orifice of the ostium can be seen between the two auricles. The scutum is divided by a central suture into two plates, separated by a deep shelf from the structures above.

This is a well-marked form, and scarcely likely to be confused with any other species. The male genitalia closely resemble those of *minerva*, from which they can be distinguished

by the much lighter harpe and the simple terminal process of the clasp. They are almost identical with the genitalia of *pallas*, but may be separated by the absence of the broad neck, from which arises the spine on the posterior process of the clasp in the latter species, in which also the condyles are very prominent.



Figs. 156–159.—*Melitaea turanica* Ersch. 156. Male genitalia, dorsal view. Kouldja (*clara* Stgr.); 157. Clasp, lateral view. "Turkestan"; 158. Penis, lateral view. Pamirs; 159. Female genitalia, dorsal view. No locality.

Distribution. It is an insect of the high mountains. I have no specimens in which the altitude is noted, but it is recorded by several authors from 10,000 to 11,000 ft. It is very variable and in other forms, described below, the insect occurs over a wide area. Specimens may be regarded as typical in which the ground-colour of the upper surface is bright, and on the under surface the fore-wings are relatively well marked and the hind-wings show the brilliant orange fasciae separated by a wide space of the ground-colour. Such specimens apparently occur only in the Pamirs and perhaps in the mountains immediately to the north. Judging from the few specimens available, examples from the Alai are already less well differentiated and approach the northern form *asteroida*. It is not to be found everywhere. Groum met with it only at Tuptschek (*in* Romanoff, 1890, *Mém. Lép.* **4** : 434). In this notice Groum pointed out that Staudinger's specimens of *pamira* really came from the Alai, and Erschoff's locality of "Samarkand" is quite indefinite. The butterfly has been taken flying with *minerva sultanensis* (1919, Rosen, *Mitt. Münch. ent. Ges.* **9** : 83), and it may be easily confused with *pallas*. The extended description is of little value in identifying the insect, but it is useful to note the following characters :—

1. The double black terminal border of both wings, enclosing orange submarginal lunules which are rounder, *i.e.* less crescentic, than those of *minerva* or *pallas*. The wide yellow discal field of the hind-wing is conspicuously free from markings.

2. On the under surface the markings are clear and regular. The black discal spots of the hind-wing are faint and extend only from cellule 4 to the costa. There is nearly always a fine black marginal line to both wings.

Localities :—Pamirs : Tuptschek (Groum, *loc. cit.*); various unspecified localities, 3100–3800 m., July (Rosen, *loc. cit.*); Alai Mountains, no further data (L.G.H.); several specimens labelled "Turkestan," "Samarkand" etc.

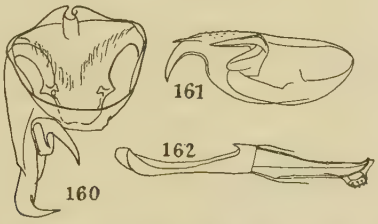
Melitaea turanica mod. ***asteroida*** Stgr. Pl. 12 fig. 1 ♂, 7 ♀.

Mel. asteroida Staudinger, 1881, *Stettin. ent. Ztg* **42** : 292. Loc. Ala-Tau Mountains.
Mel. solona Alpheraky, 1881, *Hor. Soc. ent. Ross.* **16** : 404. Loc. Thian-Shan Mountains.

Fore-wing 17–21 mm.

In the male sex the ground-colour on the upper surface is yellower and less fulvous than in typical *turanica*. The blackened veins are conspicuous. On the fore-wing the discal spots are often little emphasised, and a complete row of post-discal spots is frequently present. The double black border along the outer margins of both wings is perhaps the most conspicuous feature. The regular lattice pattern formed by the dark nervures and the transverse lines is striking and recalls the species of the *athalia* group. On the under surface the dark markings of the fore-wing are faint or obsolete. On the hind-wing the basal orange fascia is well developed, not clouded with black scales and narrow posteriorly, so that the space between this and the submarginal fascia is not unusually wide as it is as a rule in *turanica*.

In the female of this form the fore-wings are usually heavily suffused with dark grey. The disc of the hind-wing which remains orange stands out in vivid contrast, as do two or



Figs. 160–162.—*Melitaea turanica asteroida* Staudinger. 160. Male genitalia, dorsal view. "Naryn"; 161. Clasp, lateral view. "Naryn"; 162. Penis, lateral view. "Turkestan."

three orange macules which remain clear in the cell of the fore-wing and an orange fascia near the outer margin.

The genitalia (figs. 160–162) of both sexes appear identical with those of *turanica*. Perhaps the tooth on the clasp is smaller, and the angle slightly different.

This form has a somewhat extensive distribution and is found as far north as the Dzungarian Ala-Tau. From there it spreads through the western Thian-Shan and as far south as the Alai Mountains, while in the west it appears in the Alexander Mountains. Most of this district is included in the province of Semirechensk and many specimens from old collections are so labelled without further data. There is considerable variation in specimens from the same district. I have seen none from Dzungaria, but these may resemble those from Kuldja, where the insect is usually rather small and with delicate black markings on both surfaces. Such specimens grade insensibly into the form *clara*, described below, which also flies in this locality, probably at higher levels. In a number of specimens from Naryn and other places in the western Thian-Shan the black markings are extended (wider) on the upper surface and heavier also on the under surface of the hind-wings. The difference is marked in some specimens, which are sometimes referred to as *solona* Alph.

Without seeing Alpheraky's type specimens, it is not possible to say whether this application of his name is correct. In any case the presence of more typical examples from the same districts suggests that the heavy markings and

large size do not indicate a geographical variation but depend upon some physical factor (?altitude). Specimens from the Alai frequently show a brighter colouring, particularly of the bands on the under surface of the hind-wing, and must be placed between *turanica* and *asteroida*.

Records of altitude are rare. In the Kuldja district I have specimens marked 6000 ft. and it is recorded from 3000 m. by Wagner (1913, *Ent. Mitt.* **2** : 88).

Localities :—Dzungarian Ala-Tau (Staudinger); Djarkent (L.G.H.); Boro-Choro Mountains (Staudinger, var. *variegata*); Alexander Mountains (Staudinger); Kuldja, several typical specimens in Brit. Mus. and in coll. L.G.H. A majority of the examples from this district are referable to the form *clara* Stgr.; Sary-Dschas (S.E. of Issyk-kul) Wagner *loc. cit.* West Thian-Shan : " Naryn," many specimens; Bossogo (L.G.H.); Naryn Fort, May, 12,000 ft.; Tekkes, 10 June, 6000 ft.; many specimens labelled Thian-Shan without further data. Central Thian-Shan : Korla (Alpheraky, var. *solona*); Alai Mountains, several specimens so labelled, without accurate data, all tending towards *turanica*.

Melitaea turanica mod. ***clara*** Stgr. Pl. 12 fig. 2 ♂; 8 ♀.

Mel. asteroida var. *clara* Staudinger, 1887, *Stettin. ent. Ztg* **48** : 55. Loc. Kuldja.
Mel. asteroida uitasica Wagner, 1913, *Ent. Mitt.* **2** : 94. Loc. Uitas Mountains north of Djarkent.

Fore-wing 16–18 mm.

This is the smallest form of *turanica*. On the upper surface of the male the ground-colour is paler and the black markings very delicate and not infrequently obsolete in places. On the hind-wing the black submarginal line is often absent. On the under surface the markings on the fore-wing are scarcely visible. On the hind-wing the black markings are also reduced. The transverse lines in particular are very fine and often partly absent. The black nervures and the terminal line remain in all specimens examined.

The female is variable. As a rule the pattern is distinct, and the fore-wings show less suffusion than in the typical form. I have specimens in which the suffusion is nearly absent.

Localities :—of this form there are a number of old specimens in various collections labelled " Kuldja " without accurate data. Many of these are certainly part of Staudinger's original series. From its appearance *clara* probably occurs in a high and dry district, but I can find no records of altitude. It is certain that more typical specimens also fly in the same neighbourhood, and the small specimens represent the extreme of variation in the direction of small size and reduction of black markings. I have seen no specimens of *uitasica*, but from the published description it must come very close to *clara*, if not in fact identical with it.

In his Catalogue of 1901 Staudinger described very shortly two varieties of *asteroida* which I have not been able to identify with certainty. These are *pallida* from Osch and the Issyk-kul; and *variegata* from the Boro-Choro Mountains. If these are correctly referred to *asteroida* it is probable that they represent local variants which are not constant. In such a variable insect it is scarcely possible to name every grade of variation between the smallest and largest, palest and darkest forms which may occur. The name *evadne* is proposed by A. F. Hemming as nom. n. pro *M. asteroida pallida* Stgr. 1901 *nec M. pallida* Edwards 1864 (1934, *Stylops* **3** : 98).

32. ***MELITAEA ARCESIA*** Bremer. Pl. 13 fig. 2 ♂, 8 ♀.
Distribution Map 6.

Mel. arcesia Bremer, 1864, Lep. Ost. Siberia; *Mém. Acad. Imp. Sci. St. Petersb.* **1864** : 15; Pl. 1 fig. 7; 1861, *Bull. Acad. Sci. St. Petersb.* **3.**
Mel. baicalensis loc. cit. : 13; Pl. 1 fig. 6. Loc. Baical and Dahuria. This name has page priority but is unfamiliar; it has been omitted to avoid confusion.
Mel. arcesia var. *chuana* Groum-Grshmailo, 1893, *Hor. Soc. ent. Ross.* **27** : 128. Loc. Amdo.

In the case of this very interesting insect it is convenient to examine the distribution of the species complex before the different forms are considered. The wide area of distribution is separated by the great central deserts of eastern Asia into northern and southern regions, now connected only in the east by a narrow strip of country including the Kingan Mountains and the Amdo. In the north is found typical *arcesia* as the single subspecies. Throughout an extensive range it is rather local and uncommon, but relatively stable, with minor climatic variation on the lines usually found in the group. It occurs in southern Siberia from the Altai to the Kingan Mountains and northwards across the Amur river for an indefinite distance in Transbaicalia. Specimens taken by Groum in the Amdo were distinguished by him as *chuana*, and the pale tone of these is probably a reaction to a desert climate (see p. 201). Farther south, in contrast with its behaviour in the northern range, the species seems more unstable and often abundant in individuals. It spreads from Szechuan across Tibet and through the Himalaya as a series of forms (" Formenkreise "), several of which have been named as distinct species. A careful consideration of the many transitional specimens now available shows this to be wrong, and their status as a specific unit is confirmed by the genitalia, which show little variation. This remarkable series appears to consist of at least four well-marked subspecies, which are even better defined than are those of the *minerva* group. Already in south-eastern Tibet (Kham), south of the Amdo, there is pronounced modification in the shape of wide, black wing-margins, leading to the form *jezabel* Ob., which is most characteristic of the sub-alpine region in the mountains of Szechuan. At lower levels in the same district there occurs *bellona* Ob., a large and luxuriant form, while transitional specimens appear in many localities. Farther west in Sikkim and Bhutan the form is smaller, and the black markings less macular. Two modifications are to be recognised in this region, *sindura* Moore and *sikkimensis* Moore, the latter with more extensive black suffusion. I look upon these as climatic forms of a single subspecies, and in the same way a single subspecies is represented by *jezabel* and *bellona*, which represent respectively the high- and low-level forms. The former pair have a wide range and probably represent the species throughout Nepal, while they may also fly at the highest levels in Szechuan. In Ladak the facies changes again and *amoenula* Felder appears. This small insect is rather isolated and shows slight differences in the genitalia which suggest that it is more completely differentiated than any of the forms so far considered, and properly entitled to subspecific rank. Finally in Kashmir is found *balbita* Moore, another well-differentiated form, but larger and quite unlike the little *amoenula*. In the forms which comprise this series geographical isolation and marked differentiation combine to produce a superb example of a polytypic species or supraspecies. Considered individually, the series contains forms which might be regarded as seasonal, others as subspecies, and yet others which might be given full specific rank. All these forms are obviously so closely associated that they can only be dealt with as a single specific unit.

Except in the extreme east, where *bellona* occurs down to 6000 ft., these

insects all inhabit alpine or subalpine regions. The forms *sikkimensis*, *sindura*, and *amoenula* attain extreme elevations up to 16,000 ft. The geographical factor is very evident, and the range of each form is so defined that it is possible to guess the provenance of a given specimen with reasonable accuracy. In the western Himalaya *amoenula* of Ladak is closely associated with *balbita* of Kashmir and *sindura* of the main Himalaya, which occurs in Kumaon. I have seen no specimens intermediate between these three forms, but it is possible that these will be found when Nepal is farther explored. Farther east the position is different. There exists a large amount of material from Sikkim, Tibet and Szechuan, and there is no doubt that *sindura*, *sikkimensis*, *jezabel* and *bellona* constitute a continuous series. There is some evidence that ecological factors may be partly responsible for the variety of forms. In general, it can be said that as the altitude increases the insects become smaller, sometimes darker and sometimes lighter, depending probably upon climatic conditions. Thus *sindura* and *sikkimensis* fly in the same districts, the former in dry, the latter in wet, localities (Evans *in litt.*). Again, *amoenula* flies only at great heights, and is very small; *balbita*, which is found at 10,000 ft. or less, is larger; and *bellona*, the largest form, is found at the lowest elevations down to 6000 ft. In view of the obvious susceptibility to climatic conditions, it is not easy to decide whether variation in the series is due chiefly to geographical or to ecological factors. It is easy to exaggerate the importance of a localised distribution, and it must not be forgotten that the climate itself is largely determined by the geography. In this connection it is interesting to note that no greater contrast can be imagined than the passage of the Zoji-la from the dry stony mountains of Ladak (*amoenula*) to the moist and luxuriant valleys of Kashmir (*balbita*). The development of this remarkable series may be explained by the isolation of colonies upon different mountain systems, which must occur in the Himalaya, and naturally tends to the development and fixation of subspecies. The species is clearly an Angara form and the course of its passage down the Kingan Mountains and through Amdo, to reach the Himalaya, is clearly indicated. No doubt this route has been used by many creatures. It is not a little surprising that *arcesia* should be the only Melitaeid butterfly which occurs in the Himalaya, although other forms are found at the extreme east and west of the range.

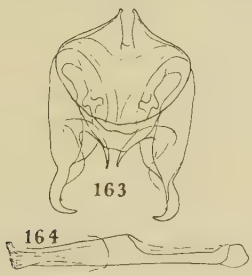
Fore-wing 17–20 mm.

In the male the upper surface, including the costa, is orange-yellow, the nervures outlined by dark scales. On the fore-wing the extreme base is dusky, and there is usually a tooth of black scales extending distally at the base of the cell. The reniform stigma is wide and often nearly square, the orbicular rounded or oval. The discal series starts on the costa in a long black mark, joined with the orbicular stigma along the costa, and consists of a complete series of small internervular spots or macules, rarely fused into a continuous band, and strongly angled in cellules 5 and 6. The post-discal series runs almost parallel to the hind margin. It is also composed of internervular spots and is rather more heavily marked especially near the costa where the spots are often fused. Posterior to this is a narrow submarginal series composed of a continuous row of black crescents which enclose the orange submarginal lunules before the rather wide black marginal border.

On the hind-wings a wide black suffusion extends from the wing-base along the inner margin to the anal angle and obscures all markings up to the inferior border of the discoidal cell or sometimes to the costa. More commonly the division of nervures 6 and 7 can be seen, and a black oval mark or circle which indicates the distal extremity of the cell. Beyond this appears an irregular black line running to the costa across the bases of cellules 4 to 7. Distal to this the discal area is generally clear, but a few small internervular dots

may be present, most often in cellules 2, 3 and 4, which indicate the discal series. The post-discal series is usually well marked as a continuous lunulate band, but not rarely the spots are discrete particularly near the costa. The black submarginal crescents are always well marked and with the rather wide black marginal border enclose the orange submarginal lunules which are often conspicuous but sometimes more or less obliterated by extension of the black marginal border.

On the under surface the ground-colour of the fore-wings is paler, and the nervures are outlined with black only near the apex. The markings in the cell are faintly indicated. The four costal spots of the discal series are usually present, but small and discrete, and the post-discal series of small dots is commonly complete. The fine, black submarginal crescents are developed only in the apical half of the wing where they form the proximal border of a conspicuous series of pale yellow submarginal lunules of which 4 or 5 anteriorly are well formed. The orange marginal border is of the same tone as the ground-colour, bordered proximally by a series of very fine black crescents which become obsolete near the anal angle. The ground-colour of the hind-wing is pale yellow, often lustrous. The nervures and the usual transverse fasciae are outlined with black scales. The basal spots are orange, fused to form a short fascia which is separated from the extreme base of the wing by a



FIGS. 163–164.—*Melitaea arcesia* Bremer. 163. Male genitalia, dorsal view. "Siberia"; 164. Penis, lateral view. Siberia.

narrow strip of ground-colour. Posterior to the discal fascia an irregular series of black linear marks is usually found which represents the post-discal series. The marginal border is orange, of even width and outlined by fine black sinuous lines.

The female is slightly larger than the male. On the upper surface the black markings are slightly heavier and more complete with a certain general dusky suffusion. The submarginal lunules are pale yellow but the preceding fascia is darker orange or reddish. The post-discal area is again paler but the reddish tint is often present in the discal area. In some specimens the alternate light and dark tones of the ground-colour make a conspicuous contrast. On the under surface the ground-colour of the hind-wings is shining pale yellow, sometimes almost white. The basal and discal orange fasciae are often narrow and may be broken up.

The male fore leg is much atrophied. The tarsus is short but slightly variable. Two segments can usually be distinguished.

The male genitalia (fig. 163) are relatively small. The somewhat tenuous tegumen is of moderate length and the saccus deeply notched. The ringwall is scarcely grooved posteriorly, the condyles strong and easily distinguished. The oval clasp terminates in a tapering posterior process which is regularly curved from above downwards and from without inwards. Small but characteristic teeth arise from its superior border, a little before the apex. The slender harpe tapers gradually to a point. Seen from above, it is strongly curved into a sickle-shape. The penis (fig. 164) closely resembles those of

turanica, *minerva* and *pallas*. The ostium folds are rather more ample and the morula less obvious in consequence.

The female genitalia have not been examined.

This species is badly represented in English collections, and no adequate series can be obtained from the various localities. The material available shows little evidence of variation of a geographical character. The race *minor* Stgr. from the Altai is sufficiently distinct to be retained as a local form, and this is shortly described below. Fruhstorfer has separated specimens from the Sajan Mountains (*carmana*) and others from the Inn Shan (*rucephala*) but I do not know these in nature. Of *chuana* Groum the typical pair and four paratypes are in the British Museum. The series is variable, the typical specimens scarcely distinguishable from normal *arcesia*, while others are much lighter, with scanty, thin markings. The latter correspond with four specimens in the Tring Museum labelled Kuku-Nor (Pl. 16 fig. 1), and it is clear that the form is common in these regions. It has the appearance of a desert modification. In the male the ground-colour of the upper surface is clear yellow, and the discal spots of the hind-wing are obsolete. The females of this form (Pl. 13 fig. 8) are scarcely paler than normal specimens from Lake Baical. It is interesting to note the contrast between the pale *chuana* of the Amdo and the entirely different and heavily marked *jezabel* and *yunnana* forms which occur a little farther south in Kham.

Localities :—Siberia : occurs round Lake Baical, in Transbaicalia and in the Amur region as far as Prokowka. In the north it reaches the 60 parallel (Herz, 1898, *Deuts. ent. Z.* "*Iris*" **11** : 242). I have seen no specimens with full data. Changai Mountains : "Uliassutai" Stgr., 1895, *Deuts. ent. Z.* "*Iris*" **8** : 347. Kentei Mountains : Stgr., 1892, *Deuts. ent. Z.* "*Iris*" **5** : 326 (9 June–1 August exactly like typical specimens). Sajan Mountains : Munko Sardyk, Fruhstorfer (*carmana* Fruhst.). Southern Mongolia : Kuku Nor, several specimens; "Amdo," no further data, in Brit. Mus. with the typical specimens of *chuana* Gr.—resemble those of Kuku Nor; Inn Shan, Fruhstorfer (*rucephala* Fruhst.). The Inn Shan are approximately 40° N. × 110° E. and lie near the Amdo in Mongolia.

The following special forms have been described :—

carmana *M. arcesia carmana* Fruhstorfer, 1915, *Soc. Ent.* **30** : 58. Loc. Sajan Mountains. A small form near *minor* Elwes, but the ground-colour on the upper surface is said to be brighter.

chuana *M. arcesia* var. *chuana* Groum-Grshmailo, 1893, *Hor. Soc. ent. Ross.* **27** : 128. Loc. Amdo. On the upper surface the ground-colour pale orange-yellow and the black pattern fine and greatly reduced. A "dry" form of deserts.

rucephala *M. arcesia rucephala* Fruhstorfer, 1915, *Soc. Ent.* **30** : 59. Loc. Inn Shan Mountains. The ground-colour on the upper surface an intense red-brown. The black markings narrow and more sharply defined than in the type.

Melitaea arcesia mod. ***minor*** Elwes. Pl. 16 fig. 7 ♂.

Mel. arcesia var. *minor* Elwes, 1899, *Trans. ent. Soc. Lond.* **1899** : 334. Loc. Altai Mountains.

Fore-wing ♂ 15–16 mm.; ♀ 16–18 mm.

This form is distinguished chiefly by its small size. In the male on the upper surface the

ground-colour is pale and yellowish. The fore-wings are short and broad, the black markings fine but complete. The discal and post-discal fasciae are broken into black dots. On the hind-wing the black basal suffusion is extensive, the discal and post-discal markings usually present. On the under surface there is little to notice. The markings of the fore-wings are nearly obliterated, except the yellow marginal lunules. The female is usually small, with wide fore-wings, but not otherwise remarkable. I think perhaps the yellow submarginal lunules on the upper surface of the hind-wings are somewhat enlarged.

The butterfly inhabits the most westerly locality known for the species, and shows the small size usually found in this group near the limit of distribution. It was discovered in the Altai by Elwes during his collecting expedition to those mountains. The description given in the *Transactions* 1899 is scarcely adequate and the only indication of a feature differing from the typical form is found in the descriptive name *minor*. Nevertheless the name has been accepted ever since, and Elwes may be taken as the author. The original series of typical male and female with seven paratypes is preserved in the British Museum. The specimens are very uniform. Staudinger also gives the Sajan Mountains as a locality for *minor*, but I have seen no specimens from there. Fruhstorfer's *carmana* described from these mountains is said to show a deeper orange-brown on the upper surface, but quite probably this should also be included here.

Melitaea arcesia jezabel Ob. Pl. 13 fig. 5 ♂; Pl. 16 fig. 8 ♀.

Mel. jezabel Oberthur, 1896, *Études Ent.* **11** : 17. Loc. Ta-tsien-lu.
Mel. leechi Alpheraki, 1895, *Deuts. ent. Z.* "*Iris*" **8** : 182. Loc. Kham or Szechuan.

Fore-wing ♂ 18–20 mm., ♀ 18–22 mm.

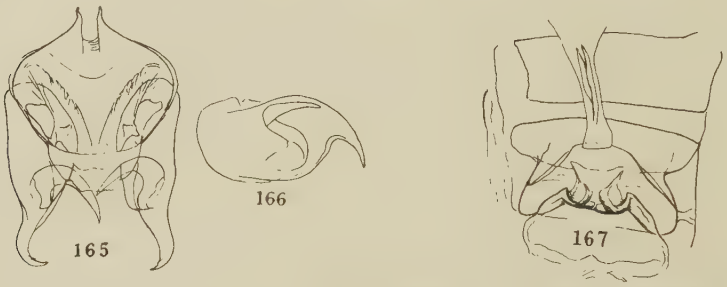
In the male the ground-colour on the upper surface is bright tawny orange. In a typical specimen the discal and post-discal series of the fore-wing are composed of small rounded or oval dots, each neatly centred between the fine black nervures, and sometimes expanded or fused near the costa. The black marginal border is wide, preceded by a narrow antemarginal line which forms the inner border of the small and obscure submarginal lunules. On the hind-wing the black basal suffusion is dense and extensive, while the wide marginal border is more conspicuous. The orange submarginal lunules are scarcely developed. The discal black spots are often indicated and the post-discal series is generally complete, continuous or discrete. On the under surface the fore-wings are tawny. The post-discal spots, and usually some of the discal series, are represented by small rounded black spots. The tawny marginal line, wider than in *sikkimensis* or *arcesia*, is of the same tone as the rest of the wing. It is defined only near the apex by four or five small yellow submarginal lunules. On the hind-wings the basal spots, the discal and submarginal fasciae and the wide marginal line are of the same tawny tone. The submarginal fascia may be clouded with darker scales, and shows the usual reddish internervular dots. The paler macules and the submarginal lunules are yellow, rarely whitish, and often lustrous. In the male specimen illustrated, the dark markings are rather heavy, approaching *yunnana* Watkins. In the female the markings are heavier. Usually the orange ground-colour is varied by yellow in the post-discal area, and in the submarginal lunules, which contrast with the slightly reddish submarginal fascia. The heavily marked nervures and extensive basal suffusion give a dusky appearance, which closely approaches the female *arcesia*.

As a rule the submarginal lunules can be seen on the hind-wing. On the under surface the ground-colour is paler. There is rather more contrast than in the male between the pale macules and the darker orange ground-colour.

Genitalia. The male genitalia (figs. 165, 166) resemble those of *arcesia*, and I can detect no unusual feature. In the female genitalia (fig. 167) the bacillus is weak and bifid, with

small and inconspicuous auricles. A striking feature is the prominent shelf which overhangs the scutum posteriorly.

I have also seen a few females with the male facies only with larger spots (Pl. 16 fig. 8). This is noted as the common form by Leech, and such specimens may preponderate in some localities. A female specimen of this male-like form has been named *kansuensis* by Nordstrom (*M. bellona* subssp. *kansuensis* Nordstrom, 1935, *Ark. Zool.* **27** (A) (7) : 26). The name is founded on four female specimens.



FIGS. 165–167.—*Melitaea arcesia jezabel* Oberthur. 165. Male genitalia, dorsal view. Szechwan, Ta-tsien-lu; 166. Clasp, lateral view. Szechwan. Ta-tsien-lu; 167. Female genitalia, dorsal view. Ta-tsien-lu.

Distribution. This is a variable form, and although certainly common in many of its flight places, there are few accurate data available. The Oberthur collection contained a long series obtained from native collectors, which are labelled vaguely " Ta-tsien-lu " without indication of the altitude or exact locality. This is the case with most specimens in English collections. Leech gave 8000 to 11,000 ft. and I have specimens from Tibet marked 13,000 ft., so it is probably an insect of the high subalpine and alpine zones. The typical form from the high altitudes in Szechuan (Ta-tsien-lu) is rather small, but larger specimens occur, possibly at lower altitudes, which pass insensibly into *bellona* described below. The insect appears to be common in Kham (S.E. Tibet), and I have seen several specimens with good data. In most cases these show rather wide black wing-margins and the markings on the disc of the fore-wings appear as continuous series, especially the post-discal series, which in typical *jezabel* is formed characteristically of small dots. Such examples represent *yunnana* Watkins (*Mel. sindura yunnana* Watkins, 1927, *Ann. Mag. nat. Hist.* (9) **19** : 318. Described from Kham). This grades entirely into *jezabel* and is transitional to *sikkimensis*. It is likely that these modifications depend largely upon climate. From the Tsangpo region Kingdon Ward brought typical *jezabel* with *yunnana* forms and marked *tibetana* females. Farther west in Bhutan specimens show the vivid contrast of white and yellow on the under surface which is found in true *sikkimensis*. In the north and north-west *jezabel* is no doubt replaced by *arcesia*, but I have no material to suggest where the change occurs. *M. leechi* of Alpheraki is best placed here (1895, *Deuts. ent. Z.* " *Iris* " **8** : 182 and 1897, *in* Romanoff, *Mém. Lépid.* **9** : 103, pl. IX). The specimen there figured as 4a is aberrant in the reduction of the black markings. The female 4b is nearer to *jezabel* on the upper surface, but the silver macules on the under surface suggest an approach to *sikkimensis*. I have no doubt that these specimens came from high altitudes above that inhabited by typical *jezabel*.

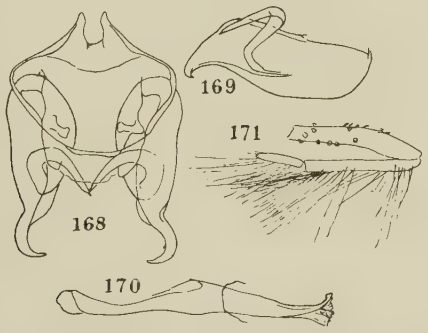
Localities :—China : Szechwan province. Appears common in the mountains in the neighbourhood of Ta-Tsien-Lu. A very large series in the Brit. Mus. without full data; Yunnan, Mu-li, Litang valley, 9000 to 10,000 ft., June 1922; River Loma, 7000 to 8000 ft. (transitional to *bellona*); Kansu, several localities (Nordstrom). Tibet : In the south-east only : How-kow, 10,000 ft., July/August (Leech); Ridong, 12,000 ft., 17 June 1911; Lu, 13,000 ft., 19 July 1913 (29° N. 93° E.); Lunang, 10,500 ft., 10 July 1913 (29° 45″ N. 94° 50″ E.); Yaregong, no further data. Specimens from the last four places start to show characters transitional to *sikkimensis*. In addition and nearer to *jezabel* is *yunnana* Watk. of which the typical pair and three paratypes are in the Brit. Mus. from the following localities :—Shirantan, Loma valley (tributary of the Mekong), Yungning, 9500 ft., 30 June; Rong Chu, 12,000 ft., 12 June (*K. Ward*).

Melitaea arcesia bellona Leech. Pl. 16 fig. 2 ♂, fig. 3 ♀.

Mel. bellona Leech, 1892, *Butts. China, Japan and Corea* **1** : 219. Pl. XXIV figs. 1–5.

Fore-wing 21–33 mm.

On the upper surface in the male the ground-colour is clear orange, the markings bold and regular. On the fore-wings the post-discal spots are rounded but enlarged so that they



Figs. 168–171.—*Melitaea arcesia bellona* Leech. 168. Male genitalia, dorsal view. Tse-kou; 169. Clasp, lateral view, slightly rotated. Ta-tsien-lu; 170. Penis, lateral view. Ta-tsien-lu; 171. Male fore leg.

may touch one another, and beyond them the nervures crossing the orange submarginal fascia are conspicuously outlined with black. The black marginal border is very wide. On the hind-wings the basal suffusion may be less dense than in *jezabel*, so that the markings in the discoidal cell can often be seen. The post-discal spots are sometimes fused and the submarginal lunules are often obliterated by the wide black marginal border.

On the under surface of the fore-wings the black discal and post-discal spots are prominent, and the yellow submarginal lunules are bordered internally by black crescents, sometimes not well developed. On the hind-wings the pale macules are yellow, often distinctly lustrous with the usual orange fasciae outlined delicately with black as also are the submarginal lunules.

The female resembles the male, but is generally a little larger, and the markings on the upper surface heavier. On the under surface the tone of orange is less vivid. All specimens seen correspond with the andromorphic females of *jezabel* and the common dusky form of the female of the latter insect does not appear to occur in *bellona*.

The male genitalia (figs. 168–170) are a little larger than those of *arcesia* and *jezabel*,

with which they seem to agree in every other respect. The greatly atrophied male fore leg is illustrated in fig. 171.

This butterfly may be regarded as a luxuriant development of *jezabel* with which it is connected by every grade of transitional form. Striking aberrations are not uncommon, and three have been figured by Leech. The known distribution of the typical form is limited to the Chinese province of Szechwan, where it flies at moderate elevations in June and July. Leech states that it is a common insect in some localities.

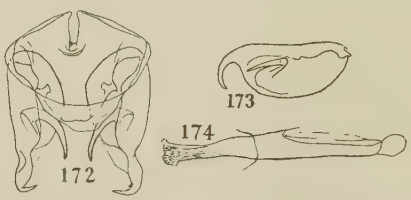
Localities :—West China : Szechwan Province; Pu-tsu-fong (common); Wa-shan; Chow-pin-sa (Leech); "Ta-chien-lu"; Wa-ssu-kow, 5000 ft., June 1890; Tay-ta-ho. Yunnan : Tsekow.

Melitaea arcesia sikkimensis Moore. Pl. 13 fig. 4 ♂; 10 ♀.

Mellicta sikkimensis Moore, 1901, *Lepidoptera Indica* **5** : 5. Loc. Sikkim; Chumbi Tibet.
Melitaea tibetana Fawcett, 1904, *Proc. zool. Soc. Lond.* **1904** : 135, Pl. IX, fig. 2. Loc. Khamba Jong, Thibet, 15,000 ft.

Fore-wing 15–18 mm. ♂ and ♀.

This form resembles *sindura*, but in the male it differs on the upper surface by the darker tone of the ground-colour. On the fore-wings the submarginal series is more



Figs. 172–174.—*Melitaea arcesia sikkimensis* Moore. 172. Male genitalia, dorsal view. Sikkim; 173. Clasp, lateral view. Sikkim; 174. Penis, lateral view. Sikkim.

developed and not rarely the spots are fused. On the hind-wing the black basal suffusion is more extensive, the antemarginal series complete and often partly fused with the black marginal border to obliterate the orange marginal lunules especially near the anal angle. On the under surface of the fore-wings the difference from *sindura* is slight, but the submarginal lunules are usually very pale or even pearly white. On the hind-wings the ground-colour appears as series of pearly white shining macules. These macules and the submarginal lunules are also white in *sindura*, but this form does not show the intense nacreous lustre of *sikkimensis*, where the contrast with the rather narrow orange and brown fasciae is really brilliant. As a rule the female is not larger than the male. On the upper surface the ground-colour is often paler, and some distinctly yellow macules are present on the fore-wings. On the under surface the markings of the fore-wings are more complete. The apex of the wing is paler, grey along the outer margin. The ground-colour of the hind-wing is grey, sometimes with a yellowish tinge. The orange transverse fasciae are sometimes much reduced in width. In the female the range of variability is great, and in some specimens the facies is most peculiar owing to reduction or obliteration of the markings on the disc of the fore-wings.

The genitalia in the male (figs. 172–174) differ little from those of typical *arcesia*. Comparing six preparations I think possibly the posterior process of the clasp is a little more acutely curved in *sikkimensis*.

Fawcett's *tibetana* refers to a form of the female of this insect. Although I have never seen a specimen quite so brightly coloured as the one illustrated by

him, very similar examples are common at the highest altitudes, and I think there is little object is retaining the name. Specimens which show characters intermediate between *sindura* and *sikkimensis* are very common. The male holotype with eleven paratypes is preserved in the British Museum.

Distribution. This butterfly is recorded up to 17,000 ft., at which altitude the smallest and brightest specimens occur. Those from the lower limit of its range at about 11,000 ft. are a little larger. The area of distribution is not well known. It is common in Sikkim where *sindura* also occurs. It is probable that the two are intimately related as *formae tempestatis* (*vide supra sindura*). Very likely the insect will be found in Nepal, but at present nothing is known of its distribution in the west. It is found in Bhutan and in many localities in south-eastern Tibet near the Himalaya. Farther east near the border of the Chinese province of Szechuan and Yunnan this form is replaced by *jezabel* Ob., and I have specimens from Lunang and Ridong in Tibet which are already quite transitional or perhaps nearer to *jezabel*. Even in Sikkim and in the adjacent parts of Tibet there occur specimens which approach *jezabel* on the upper surface, on account of the very wide black marginal borders with the lunules nearly obsolete. In many cases such specimens come from lower elevations than usual, but I have seen none from this district which fails to show the characteristic white macules on the under surface of the hind-wing. The difficulties in fixing the distributional limits are great. Not only is material scarce, especially from the eastern range, but it is often nearly impossible to identify the localities given, and until this can be done the specimen is useless.

Localities :—Sikkim : Chumbi, 10,000 to 16,000 ft., many specimens. Tibet : Phari, 16,000 ft., July, many specimens; Yatung, no further data; Tuna, 15,000 ft., 22 June 1923; Tangla, 15,000 ft., 21 June 1923; Kambu, 14,000 ft., 16 Aug. 1921. Bhutan, 11,000 ft., 20/26 July, a little larger than usual; Kham and Szechuan, mentioned by Leech, I have seen no specimens. Watkins mentions a female *tibetana* taken by Ward at 12,000 ft. on 30 Aug. at Tromda on the Tsangpo 29° lat. × 93° long.

Melitaea arcesia sindura Moore. Pl. 13 fig. 9 ♂.

Mel. sindura Moore, 1865, *Proc. zool. Soc. Lond.* **1865** : 465, Pl. XXX fig. 2. Loc. N.W. Himalaya; Kong-Ma Pass.

Fore-wing 16–18 mm.

This insect is rather larger than *amoenula* which it closely resembles. On the upper surface the ground-colour is pale, a somewhat golden orange. The black markings are firm but neat. On the fore-wings the discal series is composed of a more or less continuous series of black spots and lunules, the mark in cellule 1b produced as a short bar towards the wing base in some specimens. The four costal spots are often emphasised, to form a sinuous bar strongly convex outwardly in cellules 4 and 5. The post-discal series of internervular dots are also expanded and confluent near the costa. The antemarginal crescents are fused to form a continuous and regular black line which forms the proximal border of the orange submarginal lunules. The latter are fine and strongly crescentic, but usually clearly marked in each cellule. On the hind-wings the field beyond the cell is unmarked except for two or three spots of the post-discal series near the anal angle. The black antemarginal crescents are finer, sometimes nearly obsolete, and the orange submarginal lunules are larger than those of the fore-wing.

On the under surface the ground-colour is paler. A narrow orange marginal line is conspicuous along the outer margin of both wings. It is less regular than in *arcesia*, as the black crescents forming its inner border are much deeper. On the fore-wing the marks

in the cell and three costal spots of the discal series can usually be seen. The submarginal lunules are pale yellow, often nearly white at the apex of the wing. The pattern of the hind-wing is arranged as in *amoenula* but the colours are more saturated. The contrast between the orange, yellow and white is often very lively. In this and the following forms the lunules are more crescentic. The female may be slightly larger than the male. On the upper surface it is very variable. In many specimens the markings resemble the male, or they are only slightly heavier or sometimes even reduced. In other specimens the black markings are much heavier and more diffuse, with additional black scales filling the cellules near the wing-bases. In such examples the ground-colour is paler but the orange colour is apparent in the post-discal fasciae of both wings. The more diffuse dark scaling gives a greenish-grey tone to the insect. The under surface resembles the male. The markings of the fore-wings may be more complete. The contrast of colours on the hind-wing is usually rather less brilliant.

The genitalia do not differ from those of *sikkimensis*.

Distribution. This form was described from the Kong-Ma Pass in Kumaon. It appears to be locally common in the eastern Himalaya but most specimens I have seen are from Sikkim and south-east Tibet. In the male, *sindura* is fairly constant and well characterised although specimens transitional to *sikkimensis* are not rare. The female is very variable and less constant, and forms indistinguishable from those of *sikkimensis* apparently occur with well-developed *sindura* males. These two forms are indeed closely associated and I have well-marked specimens of both with the same locality labels from several places in Sikkim and south-east Tibet (Gyantze, Yatung, " Sikkim "). I am told by Brigadier Evans that *sindura* is found in dry places and that in wet districts its place is taken by *sikkimensis*. From the look of the two insects I should think this is quite likely and it is possible that both forms occur in some localities although no doubt on different ground. The insect flies at very high levels. I have specimens taken at various altitudes from 9000 to 13,000 ft. Moore stated in his description that the original specimens were found on one patch of stony pasture at 16,000 ft.

The typical specimen (♂) and two male paratypes are in the British Museum.

Localities :—N.W. Himalaya : Kong-Ma Pass (Moore). Sikkim : several labelled so without further detail; Yatung. S.E. Tibet : Gyantze 13,000 ft., 26 Aug. 1932; Ganze, 11,000 ft., 19 Aug. 1927; Lunang, 10,000 ft., 10 July 1911; Kamba-Jong, no further data. Western Tibet : 9000 ft., July, no further data. S.W. China : Alpheraky, 1897, *in* Romanoff, *Mém. Lépid.* **9** : 106, gave Kham and Ta-Tsien-lu. These records need confirmation.

Melitaea arcesia amoenula Feld. Pl. 13 fig. 3 ♂.

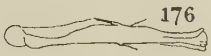
Mel. amoenula Felder, 1867 (?1866), *Novara Reise. Lep.* **1** : 392. Loc. Ladak; Rupshu etc. W. Himalaya.

Fore-wing 13–14 mm.

On the upper surface the ground-colour is rather pale orange. The black markings are delicate, the orbicular stigma compressed and elongated. The black discal spots are often conspicuous, particularly the horizontal mark in cellule 1b. The four costal spots are usually fused and in most specimens joined to the orbicular stigma by a black bar along the costa which is paler in the basal half of the wing. The post-discal spots are generally complete but very small, except the two next the costa. In many specimens they are set very near the discal series, leaving a wide post-discal fascia which often contains a series of paler yellowish macules. This arrangement is the opposite of that usually found in *balbita*. On both wings the regular yellow submarginal lunules are narrow and crescentic, defined

internally by a few black scales which are often scarcely sufficient to form a continuous line. On the hind-wings the usual black suffusion is present at the base. The discal and post-discal series are represented only near the anal angle as a rule, the latter often by two or three prominent spots.

On the under surface the ground-colour is paler and a golden-yellow marginal line is present along the outer margin of both wings. On the fore-wings the markings are less distinct than on the upper surface. The post-discal fascia of paler yellowish macules is usually rather more obvious. The submarginal lunules are whitish, especially in the apical region. The hind-wings are marked by spots and fasciae in three colours. The basal spots and the discal fascia are orange, enclosing four spots of shining white. The discal field is divided by fine black striae into a yellow proximal and a white distal fascia. The yellow submarginal fascia is often a good deal clouded by dark scales, but the internervular yellow macules are distinct and one or more of them may show a fine black central point. The submarginal lunules are white.



FIGS. 175–176.—*Melitaea arcesia amoenula* Felder. 175. Male genitalia, dorsal view. Ladak; 176. Penis, lateral view. Ladak.

The male genitalia (figs. 175–176) are naturally very small and compact. The posterior process of the clasp appears relatively stouter and less curved than in typical *arcesia* and the saccus is less prominent (three specimens). The apex of the penis is less prominent.

Female genitalia not examined.

This very constant form is the smallest of the species-complex. I have seen it only from Ladak, where it is the only form yet discovered. Felder recorded it also from Rupshu. It is found at very high elevations of about 14,000 ft. in dry stony country. It is interesting that *amoenula* should fly so near to the extensive district inhabited by *balbita*, which is an insect of lower levels and luxuriant vegetation. As far as I know there is no overlap between the distribution areas of the two forms and I have never seen any intermediate specimens. The two inhabit different mountain systems with very different climates. Considered alone *balbita* and *amoenula* are so unlike that it would be reasonable to separate them specifically. Taken in conjunction with the related forms, they all appear to me to fall into one series, and I have dealt with them as subspecies. The male holotype of *amoenula* is in the Tring Museum.

Localities :—LADAK : Khema, 16,000 ft., 28 July 1931; Kardong, 14,000 ft., Aug. 1889. RUPSHU : (Felder), Pangchog and Marka.

Melitaea arcesia irma subsp. n.

Fore-wing ♂ 15–17 mm., ♀ 17–19 mm.

This is rather a broad-winged form, slightly smaller than *balbita* Moore. On the upper surface there is a good deal of dark greyish suffusion at the wing-bases and along the costa of the fore-wing. The black outer-marginal border of both wings is wide and heavy, but the submarginal lunules are usually faintly indicated in pale grey or whitish. The usual

black markings are small and complete. The post-discal fascia of the fore-wing is not especially wide, and the ground-colour there is pale, particularly near the costa where it is distinctly yellow. The submarginal macules are quadrate, regular, and deep orange. On the hind-wings, in spite of the dark suffusion, the discal and post-discal markings are also very complete. On the under surface of the fore-wings the black markings are well formed upon a rather pale ground-colour. On the hind-wings most of the markings are clearly outlined with black. The series of silver macules in the post-discal area, proximal to the orange submarginal fascia, are short and rounded, with clearly defined black outlines. The submarginal lunules are deep, almost half-moons, as in *balbita*. The female is slightly larger than the male, and the colour contrast on the fore-wing is a little more definite.

This very interesting form is well differentiated, combining some characters of *balbita* and of *jezabel*. On the upper surface the yellowish post-discal fascia and the reddish submarginal macules show colour contrast of the same type as appears much better defined in the female *balbita*. The specimens, altogether about 30, were received from Lieut.-Colonel F. M. Bailey, who tells me that they were taken by native collectors, and that he was not able to enter Nepal himself. The butterflies were taken on various dates in 1936, between 11th July and 27th August. They are marked with a number of localities, of which the only one appearing on an ordinary map is Simkot (Lat. 29.56 × Long. 81.37). Colonel Bailey tells me that his men ranged northwards from here, and went just over the border into Tibet. It is not unlikely that the route lies along the Karnali River. No doubt the form *irma* is developed on a mountain system, distinct from that of Kumaon and of Sikkim. These are the only Melitaeid butterflies I have seen from Nepal, which is scarcely explored from this point of view. The general aspect suggests a subalpine form, and it is probable that a high-level form also exists in the district. Colonel Bailey has very kindly given permission to include a description of this insect in the present Catalogue, and has suggested the name *irma* after Mrs. Bailey.

Localities (not found on any map consulted by me):—West Nepal: Limotang; Yakpa; Torpa; Sakse Jula; Dunga; Yanga; Sata; Barang-Se; Suna Takpa; Mo-Chu; Nang-Mu. Western Tibet: Limi; Gyangri.

Melitaea arcesia balbita Moore. Pl. 13 fig. 6 ♂; 12 ♀.

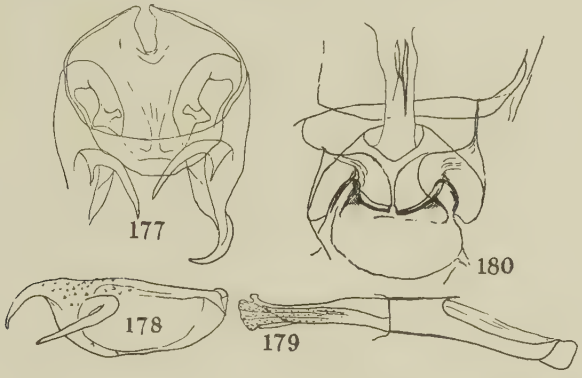
Mel. balbita Moore, 1874, *Proc. zool. Soc. Lond.* **1874**: 268, Pl. XLIII fig. 5 ♂. Loc. Sonamurg; Kashmir.

Fore-wing ♂ 17–20 mm., ♀ 20–22 mm.

This form differs from typical *arcesia* in the following particulars. The reniform and especially the orbicular stigmata are narrower and more compressed. The discal series is accentuated, the four costal spots usually fused to form a straight solid bar which is less oblique than in *arcesia* and runs almost at right angles to the costa. The discal area is conspicuously wide in most specimens, the post-discal series of spots usually discrete and relatively small. The submarginal series is strongly developed as a continuous black band which, with the wide black outer margin, forms a conspicuous border enclosing the orange marginal lunules. On the hind-wing the discal series is often present but rarely fully developed in the male. As a rule the discal field is wide and unmarked, in contrast to *arcesia*, in which the post-discal series is usually present. In the female of *balbita* a few spots of this series are found near the anal angle, and exceptionally these may be indicated in the male also. The black submarginal crescents are usually strongly marked enclosing, with the wide black margin, large orange lunules which form a striking border to correspond with that of the fore-wing, and all the more conspicuous on account of the clear orange discal field.

On the under surface in the male the tone of colour is generally brighter and yellower, but contrast is less marked. The yellow ground-colour of the hind-wing extends to the wing-margin, and the orange terminal line, a conspicuous feature in *arcesia*, is often absent on both wings or only faintly indicated. The basal transverse orange fascia of the hind-wing is indefinite and usually scarcely darker than the ground-colour. In the submarginal orange fascia the small round red spots are clearly defined.

The female is a handsome and variable insect. On the upper surface in most specimens the ground-colour of both wings is yellowish, and can be seen in the cell, in the wide discal area of the fore-wings, and in the submarginal lunules. This contrasts strongly with the post-discal fascia of deep orange or reddish macules which is especially striking on the hind-wing. Specimens showing more uniform tawny colouring and little contrast are not uncommon. On the under surface the ground-colour of the hind-wings is pale yellow or white and shining. The terminal line, which can usually be seen along the outer margins, and the transverse fasciae of the hind-wings are yellowish-grey as a rule, and only the distinct round spots in the submarginal fascia are clearly orange.



Figs. 177–180.—*Melitaea arcesia balbita* Moore. 177. Male genitalia, dorsal view. Kashmir; 178. Clasp, lateral view; 179. Penis, lateral view; 180. Female genitalia, dorsal view. Kashmir.

The male genitalia (figs. 177–179) resemble those of *arcesia*, but are slightly larger. The structure of the female genitalia is complicated (fig. 180). The auricles are of moderate size, and the flap scarcely overhangs the ostium. A weak bifid bacillus is developed near the neck of the bursa, but as a rule it cannot be traced to connect with the low, broad cone. The scutum is rather small and the sulcus not obvious. There is probably little difference from *jezabel*.

This form shows only minor variation. Some specimens approach *arcesia* but the distinction is always sufficiently well marked and I have seen none that could properly be called intermediate. It is perhaps the most completely differentiated member of the series, and appears to me to rank as a true subspecies. It has evidently a wide distribution in Kashmir and is noted by Evans as rare in Chitral. The insect flies at various levels from 7500 to 14,000 ft. (Evans) and where it occurs it is not associated with other forms of the series at higher or lower levels. It is strictly confined to the western Himalaya and in the east in Ladak it is already replaced by *amoenula* and in Kumaon by *sindura*. It is rather doubtfully reported from the Karakorum Mountains.

The typical pair (♂ and ♀) are in the British Museum.

Localities :—Kashmir : Sonamurg, N.E. Kashmir (Type); Goorais Valley,

8000 ft., J. H. Leech; Phailguam, 7500 ft., 25 June 1900; Pahlgam—Aru 26 August; Gulmurg, July; Chumpur, 15 June 1879, de Niceville; Pangi, June; N.W. Kashmir, 9000 ft.; Aru Bridge, 9000 ft., 24 June 1900; Chillum—Astor, 10,500 ft., 20 July 1920. PUNJAB: Kangra—Hocking. CHITRAL: rare in July/August from 9000 to 14,000 ft. (Evans). PAMIRS: Togomshibur, July 1928 (*N.B.* probably near the Chitral border).

33. ***MELITAEA DIAMINA*** Lang. Pl. 12 fig. 5 ♂. Distribution Map 6, p. 187.

Pap. diamina Lang, 1789, *Verzeichniss* (Ed. 2) : 44. Name for Ernst & Engramelle, *Pap. d'Eur.* : Pl. LXII fig. 31 bis : 251. Loc. Hailbron.
Mel. dictynna alpestris forma (*alpina*) n. Fruhstorfer, 1917, *Arch. Naturg.* **82** (A) (2) : 14. Loc. Southern Switzerland.

It is convenient to make a general survey of this species before the special forms are considered. The distribution is enormous, from the Atlantic Ocean to the Pacific, across the whole Palearctic region. It occurs from sea-level to the limit of sub-alpine life, and I have taken it in the Engadin at nearly 7000 ft. The insect requires a moist and temperate climate, and in southern Europe it is not found south of the river Ebro in northern Spain and the plains of northern Italy at the foot of the Alps. It is recorded from the Caucasus and from the southern Urals, but I have seen no specimens from southern Russia or from western Siberia. It occurs in eastern Siberia, and seems to be common in the Altai, Kentei and Sajan Mountains up to an altitude of 4000 ft., but it is absent from Mongolia. In the extreme east is developed a well-marked subspecies, *regama* Fruhst., which sweeps farther south from Corea through central China as far at least as Changyang in Hu-pei, and extends eastwards to Japan. In the north of Europe it does not appear in England, and it is rare in northern France and Belgium. It is sporadic or absent from many localities in northern Germany, but it has been recorded from the south of Norway, Sweden and Finland. In Russia it certainly extends as far north as Leningrad. In the Balkans it is absent from Greece, local and often rare elsewhere in the Peninsula. It is clear that *diamina* inhabits the decidual forest zone, of which indeed it is a most characteristic species, widely distributed and often abundant. Although stable in the greater part of its range, there is interesting and confusing variation in south-western Europe. At first sight this appears quite capricious, but I have come to the conclusion that the two main forms, *diamina* and *hebe*, separable on the characters of the underside, are of subspecific rank although not well differentiated. I have formed this opinion with much hesitation in view of the marked variation produced in this group by climatic conditions, but I do not think it is possible to explain, on ecological grounds, the distribution of these two forms. The occurrence in northern Italy and Switzerland of typical *diamina*, which is abruptly replaced by the very different *orientalpestris* in the south and east, is most difficult to explain, unless some factor other than climate is involved in the production of these two forms. This view is accepted in the following account of the variation, which is easier to explain and appears more coherent when studied from this point of view.

The very definite variation on the under surface depends upon the intensity of the colouring, particularly of the hind-wings. In the typical *diamina* the pale basal and discal macules are of very nearly the same shade as the ground-colour, the darker transverse bands are relatively pale, and their tone is never very intense. This is generally a high mountain form, of which the characters are rarely well marked below an elevation of 4500 ft. It is found only in the

western Alps of Switzerland and France, the Pyrenees, where the characters are very well marked, and in northern Spain. At lower elevations and on the plains in this area, the features are mostly less definite, and the specimens grade insensibly into a form nearer *hebe*, with indefinite characters, which is very widely distributed. It appears that *diamina* represents the extreme modification in one direction, and that this can be attained only in certain districts. There can be no doubt that the pale under surface is entirely unrelated to the much more striking variation in the upperside pattern. A subspecific character is strongly suggested by the distribution area of typical *diamina*, which is closely associated with that of *Mellicta athalia pseudathalia* Rev.

In northern and eastern Europe the species occurs in the form described as *hebe*, of which the under surface contrasts strongly with *diamina*. On the hind-wings the pale basal and discal macules are often shining white, the transverse fasciae vivid chestnut brown, so that the colours are richly variegated. Very beautiful examples of this form are found on the moors of southern Germany at an elevation of about 1000 ft. In specimens taken in the mountains in this district, where it may occur up to 5000 ft., the contrast of colours is usually less conspicuous, but the orange tone remains bright, and I have seen no specimens from eastern Europe which could be confused with a well-marked western *diamina*. It is in the form *hebe*, though not in its extreme development, that the species has its widest distribution, not only in Europe but also in Asia. Most specimens from Siberia are best placed here, and the typical *diamina* does not occur in the East, although it is unfortunately true that no specimens from the Caucasus nor from western Siberia are available for comparison. Closely allied to *hebe*, and probably derived from it, is the small and brilliant *orientalpestris* Vrty of Carniola, in which the characters of *hebe* are accentuated. This seems to me a form of special interest, and an unexpected development. The distribution is imperfectly known, but it appears to extend from the plains and foothills near the Italian lakes eastwards to the mountains of Carniola, where it occurs up to 4000 ft. Its general characters are apparent in all specimens I have seen from lower levels in this district, and in those from the plains of northern Italy. In the production of this form, there may be a geographical factor, as *orientalpestris* more or less modified appears in the Bergamasker Alps and round the outlying mountains, while *diamina* is found on the main Alpine chain. The distinction between the two forms is usually clear although their habitats are contiguous. I feel that this is an argument in favour of regarding the two as subspecifically distinct. It must be remembered, however, that the main Alpine chain has very different physical characters from the outlying southern mountain groups. Although it is possible to distinguish the three forms mentioned above, they are not always well differentiated. It is only the more extreme specimens which can be placed with certainty. Nearly everywhere there occur examples with weakly marked *hebe* characters, which may be considered normal. In this connection it is interesting to notice that Lang (*loc. cit.*) recorded both *diamina* and *dictynna* (*hebe*) from Augsburg, and indeed it is impossible to place accurately many specimens.

On the upper surface the variation consists principally in the greater or less development of the black markings. Throughout the greater part of its range the insect is very stable. Specimens from high levels are often smaller, and show the most extensive black suffusion, with obliteration on the hind-wings of all markings except the submarginal series. This was first pointed out by Frey, and conforms to the general rule among Melitaeid butterflies, but in the case of *diamina* I have not been able to confirm a constant difference in size, nor in the

extent of the black markings between lowland and mountain specimens. At the same time, the difference has been mentioned by several authors, and possibly the distinction is marked in certain localities. Examples from the Altai Mountains, with pale ground-colour, have been named *erycina* by Lederer, and those from the Amur *erycinides* by Staudinger. It is possible that some of these oriental specimens have shorter and wider fore-wings than the European examples, but from the material available I find it impossible to separate them in most cases, and in my opinion these names are not required. It is said that in Siberian specimens the orange macules on the upper surface are replaced by yellow. Such specimens occur also in Europe, and although they may be commoner in Siberia, they remain exceptional even there, and the character provides no racial distinction. A more notable variation appears in the extreme west and east of the distribution area. This consists of an extension of the orange pattern of the upper surface which may become so extensive that the facies is quite changed and resembles that of *athalia*. Extreme examples of this type are found only in Spain, the Pyrenees and northern Italy and in the east on the Amur. Still farther east, near the Pacific coast, in the subspecies *regama* already referred to, this feature is carried a step farther in the same direction. The character is best marked at low levels and occurs in *diamina* and in the *orientalpestris* modification of *hebe* as the forms *vernetensis* and *wheeleri* respectively, with frequent transitional specimens. On the Amur, where the place of *wheeleri* is taken by the slightly different *protomedia*, transitional forms are again common, leading to more normal specimens which, in this region, are usually very similar to the *orientalpestris* of Italy. In Corea and northern China the place of true *diamina* is taken by the well-marked vicariant subspecies *regama*, which is very pale on the upper surface. These forms with pale uppersides all occur in warm localities, but if a warm climate produces the extension of the orange pattern, some other factor must be responsible for the modification of the under surface of the hind-wings. In the case of *hebe* a tendency to the development of the *athalia* facies has been noticed in several localities, including the southern Tirol, Laibach and Chiusa in northern Italy.

Fore-wing ♂ 18–20 mm., ♀ 19–21 mm.

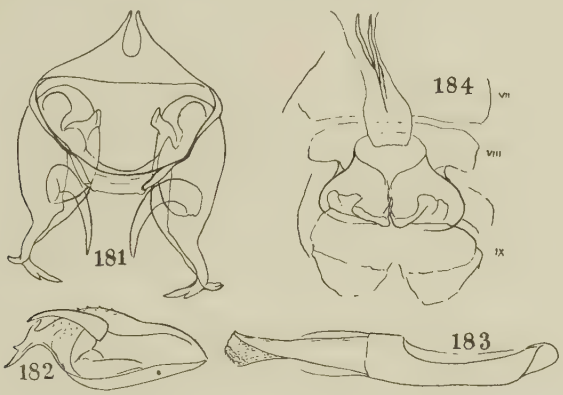
On the upper surface in the male the markings of the fore-wings resemble those of *athalia*. They are generally so heavy and extensive that the wing-base is entirely black. The orange ground-colour only appears as one or two conspicuous marks in the cell, and two or three series of rounded spots in the distal half of the wing. Of these, the marginal lunules are not infrequently obliterated by the wide black marginal border. On the hind-wing the markings are often even more obscured by extension of the black scaling. The marginal lunules and the discal series are often quite absent. Usually the submarginal series alone is clearly visible. In most localities there occur specimens in which the orange is replaced by whitish or yellow, particularly on the hind-wings.

On the under surface the ground-colour of the fore-wings is again orange, with the orange markings of the upper surface incompletely indicated by yellow macules. The usual striae are present at the wing-base and in the cell. The discal series is often incomplete in cellules 2 and 3. The post-discal series is rarely well developed, often absent. A row of yellow macules beyond it, often present only near the apex, is a constant feature. Of the same pale tone are the yellow marginal lunules, beyond which is a narrow orange terminal border, of even width, which extends along the entire outer margin, usually distinct but sometimes so pale that it is scarcely noticeable. On the hind-wings the ground-colour is yellow. The basal spots are orange outlined with black. External to these are

five large macules of whitish or pale yellow. The distal components of the discal fascia are of the same tone, commonly rather paler than the ground-colour but without strong contrast. The dark basal and submarginal fasciae are brownish or greenish orange, and are often narrow. The submarginal fascia contains a series of small black dots in cellules 1b to 6, each of which is placed close to the submarginal lunules. The dots may be almost obsolete, and more rarely they are represented by small circles (ab. *grammani* Vorbrodt). A yellow or orange terminal line is present along the outer margin as on the fore-wing.

The female is usually slightly larger. On the upper surface the markings may resemble those of the male. More often the ground-colour is paler orange, and the black shading less extensive. The distal macules are often very pale or whitish, particularly on the hind-wing.

This form is characterised chiefly by the subdued colouring of the under surface of the hind-wing. Such a specimen is figured by Ernst, and therefore represents the typical *diamina* of Lang. In the form *alpestris* described by Fruhstorfer from various localities in southern Switzerland, the pale tone of the under surface is particularly mentioned, and in my opinion this name should be considered a synonym of *diamina*.



Figs. 181–184.—*Melitaea diamina* Lang. 181. Male genitalia, dorsal view. Pyrenees; 182. Clasp, lateral view; 183. Penis, lateral view; 184. Female genitalia, dorsal view. Switzerland.

The male genitalia (fig. 181) are short, the ringwall scarcely grooved, the condyle delicate and not easy to display. The saccus is deeply notched. The clasp (fig. 182) is oval, and seen from above the terminal process is bifid. In lateral view the process is gently curved from above downwards, and near the base arises a strong tooth which is directed upwards. Just before the apex a second smaller tooth is present in most European specimens, but this may be absent in oriental examples. The harpe is long and without teeth. The apex of the penis (fig. 183) is but little upturned, the penis folds and morula prominent.

The female genitalia (fig. 184) are distinctive. The prominent cone is widely open, and from it arises a long and slender forked bacillus. The ostium is scarcely visible. The wide scutum is only partially divided by a median sulcus.

The ovum appears to be undescribed. The larva is well known, dark grey marked with rows of blue-white points. The lateral spines are yellow, the dorsal series black (Frionnet).

The larva feeds upon a variety of plants, including *Veronica*, *Plantago*, *Melampyrum* etc. The imago flies from May to July according to the locality. It occurs chiefly in damp places and swampy meadows. In the case of true

diamina there is only one brood annually, but in the form *hebe* there are records of the occasional emergence of a few second-brood specimens at the end of the summer at Zurich in Switzerland, in Bavaria and elsewhere. In northern Italy at low levels a summer brood occurs constantly, usually in the form *wheeleri* described below.

Localities :—Southern Switzerland : from the Engadin westwards. At Pontresina at 7000 ft.; Bernese Oberland, well marked in the mountains, transitional to *hebe* at low levels. France : Alps of Savoy, and southwards to the Maritime Alps and Dauphine, extending thence into Italy; Pyrenees, at high elevations, well characterised.

It is generally true that *diamina* occurs in the mountains of south-western Europe from 4000 ft. upwards. The characters become better marked as the altitude increases. At lower elevations the characters of the form *hebe* begin to appear.

Melitaea diamina mod. ***vernetensis*** Rondou. Pl. 12 fig. 6 ♂.

M. dictynna var. *vernetensis* Rondou, 1902, *Act. Soc. Linn. Bordeaux* **57** : 24. Loc. Pyrenees Or. (Vernet-les-Bains).

Fore-wing ♂ 18–20 mm., ♀ 18–21 mm.

In this large form the markings on the upper surface are distinct. The black discal macules are often reduced in cellules 2 and 3 to increase the width of the orange post-discal fascia. The hind-wings are heavily clouded with black at the base, but the orange markings show up boldly in the discal area, although the submarginal lunules are rarely large. On the under surface the ground-colour of the hind-wings is yellow, the transverse fasciae yellowish-brown and narrow, showing no strong contrast with the ground-colour in most specimens. The submarginal " *diamina* spots " are often nearly obsolete, and the terminal orange line may be scarcely darker than the ground-colour.

From this description it will be seen that *vernetensis* may be looked upon as a form of the western *diamina* specially modified by reduction of the usual black suffusion on the upper surface. This tendency is found throughout the genus in races from warm southern localities, and in *diamina* the modification is probably related to climatic conditions. At Vernet it flies at about 3000 ft. and ordinary specimens are rare. It is not restricted to the eastern Pyrenees, and I have taken quite well-marked specimens as far west as Gedre, although there most examples are nearly typical.

The species crosses the Pyrenees into Catalonia, but it appears not to cross the Ebro river. Here at the southern limit of its range a striking form is developed. On the upper surface the *athalia*-like facies remains, and on the under surface in many specimens the hind-wing shows a greenish-grey ground-colour with almost no colour contrast. The usual orange fasciae are represented by some darker greyish-brown scales, and the dark submarginal spots are not developed. This form has been described as *codinai* by de Sagarra, from specimens taken near Tarragona. In well-marked specimens it shows on the under surface an extreme development of *vernetensis* characters. On the upper surface there is great resemblance to the small *wheeleri* of northern Italy. The specimen illustrated, which shows unusually well-marked *codinai* features, is from an elevation of 1500 m. and is very possibly a specimen of the second generation. I have also one Spanish specimen taken near Potes in the Asturias at about 1000 ft., which is even larger than most French *vernetensis* (Plate 13 fig. 1). The pattern on the upper surface is paler and more complete, and it was mistaken in the field for *deione* Hb. Unfortunately I have only a single

specimen of this form, which shows an intensification of *vernetensis* characters and may be placed as transitional to *codinai*, while there is a very striking approach to the eastern *regama* Fruhstorfer. It may be remarked that in southern France and in the Maritime Alps *diamina* is undistinguished, although a tendency towards the *vernetensis* colouring is sometimes present (*magnobscura* Vrty; *magnaclara* Vrty).

Localities :—FRANCE : Pyrenees, especially well marked in the eastern mountains near Vernet-les-Bains. Less common and with the characters less definite in the central Pyrenees at Gedre, 4000 ft., and transitional specimens even at Gavarnie, 5000 ft. SPAIN : Potes, Asturias, 1000 ft., July 1935; Galicia and Tarragona (Agenjo). CATALONIA : Tortosa (*codinai* de Sagarra), Puigmal and Santafé, 1200 to 1500 m., July/Aug.

Melitaea diamina hebe Borkh. Pl. 12 fig. 4 ♂.

Pap. dictynna Esp., 1777, *Die Schmetterlinge* **1** : 382, *nec Pap. dictynna* W.V. 1775. Loc. No locality given.
Pap. hebe Borkhausen, 1793, *Rheinisches Magazin* **1** : 270. Nom. n. pro *dictynna* Esp. preocc.
Pap. corythalia Hübner, 1800, *Samml. europ. Schmett. Pap.* **1** : 7. Nom. n. pro *dictynna* Esp. *nec Pap. corythallia* Esp. 1780.
Cinclidia orthia Hübner, 1818, *Verz. bekannt. Schmett.* : 29. Nom. n. pro *dictynna* Esp. preocc.
Mel. dictynna var. *erycina* Lederer, 1853, *Verh. zool.-bot. Ges. Wien* **3** : 357. Loc. Altai Mts.
Mel. dictynna var. *erycinides* Staudinger, 1892, *Deuts. ent. Z.* "*Iris*" **5** : 326. Loc. Kentei Mts.
Mel. britomartis Assmann, 1847, *Z. Ent. Breslau* **1** : 2 (see note below).

N.B.—Although no locality for *dictynna* is given by Esper, the specimen figured is very typical of the form of north-eastern Europe. Esper said the species is very common, and he probably took the specimen figured near Erlangen. The name was soon recognised as a homonym, and Borkhausen's *hebe* was accepted by Hoffmansegg as long ago as 1804 (*in* Illiger, *Mag. Insektenk.* **3**).

This form agrees in size with typical *diamina*. On the upper surface there are no distinctive features. On the under surface the ground-colour of the fore-wings is brighter, and in a well-marked specimen the several series of yellow macules which indicate the pattern are conspicuous. On the hind-wings the colouring is more intense. Frequently the basal spots, the post-median series and the submarginal lunules are white and shining, and stand out boldly from the darker ground-colour, when the effect is very lively. The dark basal and submarginal fasciae are bright chestnut red, usually wide, and the latter in particular shows up in strong contrast with the pale spots which enclose it. The orange marginal border of both wings is very obvious.

The characters are particularly well marked in specimens from the bogs and mosses of Germany and Austria. At higher levels the colouring is commonly less brilliant.

Localities :—EUROPE : FRANCE : widely distributed on the plains except in the extreme north. Up to 3000 ft. on the mountains of the central massif, but replaced by *diamina* in the eastern Alps and Pyrenees. BELGIUM : scarce and local. SWITZERLAND : the usual form from the Rhone valley northwards. GERMANY : common in the south, rare or absent in the north-west. SCANDINAVIA : recorded locally in the extreme south. FINLAND : only in the south. ESTHONIA and LATVIA : recorded locally. AUSTRIA, CZECHOSLOVAKIA, POLAND and HUNGARY : common. RUMANIA, SERBIA, BOSNIA and HERCEGOVINA : scarce and local, only in the mountains (Rebel). In a series from Dervend in Bosnia the orange pattern on the upper surface is well developed (*praxilla* Fruhst.). BULGARIA : only in the Rilo Mountains. Examples from Koste-

netz tend to *diamina* (L.G.H.). Russia: a series of dark specimens from Blagowitza in Podolia is in the Brit. Mus. No other Russian specimens seen, but recorded by Erschoff and Feld. from all provinces as far north as Leningrad. ASIA: Armenia: recorded by Rebel. Caucasus: recorded by Rebel. Siberia, Western districts: provinces of Tobolsk and Tomsk etc. (Erschoff). Central districts: Provinces of Yeniseisk and Irkutsk (Erschoff). Altai Mountains, common at 3000 to 6000 ft.; Tchuja valley, 4000 ft.; Bashkaus, 6000 ft.; Ongodai, 3000 to 5000 ft.; all collected by Elwes. Changai Mountains, no further data, Brit. Mus.; Kentei Mountains, no further data; Sajan Mountains, no further data; many specimens labelled "Irkut" and "Transbaical". Eastern districts: Charborofka (Brit. Mus.), many specimens without full data. Appears widely distributed in Amur; Central Ussuri, Wahk-pluss (Brit. Mus.).; source of the river Iman (Brit. Mus.); many specimens are transitional to *protomedia*.

Melitaea diamina hebe mod. ***orientalpestris*** Vrty.

M. diamina race *orientalpestris* Verity, 1931, *Ent. Rec.* **43** : 81. Loc. Carnic Alps, Sappada.

Fore-wing 17–19 mm.

Although the actual difference is not great, this form is decidedly smaller than ordinary *hebe*, from which it is clearly derived. On the upper surface the insect is not remarkable. In many specimens the markings of the hind-wings are nearly obscured by the black ground-colour. On the under surface the markings are very bright. In particular those of the hind-wings are often most vivid, with the wide transverse fasciae of dark chestnut brown forming a brilliant contrast with the pearly basal and post-median macules. This is the more remarkable as the insect occurs at high levels in the south-eastern Alps where a form nearer to *diamina* of Switzerland might be expected to be found. At lower levels the black upper surface of the hind-wings of this form is quickly modified and the more complete orange pattern appears. Such specimens are transitional to the *wheeleri* that occur on the plains of northern Italy, and may be looked upon as specially modified *orientalpestris*. Even on the plains near Turin and Milan there occur specimens of the first brood which are best referred to this form, although most examples from this district are obviously modified in the direction of *wheeleri*.

Localities:—Carniola in alpine surroundings. I have specimens from the Val Degano, 1000 m., and Verity records Sappada, 1300 m. A series from Mas in the Val Cordevale, 450 m., shows many examples less melanic on the upper surface, but not otherwise different. This form is well characterised by the vivid colouring of the under surface of the hind-wings. Its existence is one of the most interesting facts established by Verity. The distribution is imperfectly known at present, but it appears to encircle the eastern extension of typical *diamina*. In eastern Asia many specimens from the Amur can scarcely be separated from *orientalpestris* or from the transitional forms referred to above. The presence of the same modification in Italy and in the Amur seems to me to suggest some (climatic) modifying factor which is common to the two localities.

Melitaea diamina hebe mod. ***wheeleri*** Chapm. Pl. 12 fig. 12 ♂ gen. secunda.

M. dictynna var. *wheeleri* Chapman, 1910, *Ent. Rec.* **22** : 71. Loc. Reazzino.
M. dictynna aurelita Fruhstorfer, 1917, *Arch. Naturg.* **83** (A) (6) : 12. Loc. Alserio, Lombardy.
M. dictynna briantea Turati, 1920, *Nat. Sicil.* **23** : 232 (fig.). Loc. Lago d'Alserio.

This form is usually slightly smaller than *vernetensis*. On the upper surface the pattern is very distinct in well-marked specimens, and more regular. In particular the discal

macules of the fore-wings are well developed, and the markings at the base of the hind-wings can often be distinguished. On the under surface the difference is more striking. The ground-colour of the hind-wings is pale, often white and shining. The transverse fasciae are relatively wide and completely filled with bright orange-brown, so that there is vivid contrast. The submarginal "*diamina*-spots" are obvious and the orange terminal line distinct.

It is only in the area of *wheeleri* that this species normally produces a second brood, although in many warm localities occasional second-brood specimens have been noticed. In the case of *wheeleri* these are very small, 24–32 mm. in expanse. They are brightly coloured, the black markings on the upper surface less intense and more delicate than in specimens of the first brood. On the under surface of the hind-wings the tone of all markings is paler than in first-brood specimens, but there remains a lively contrast between the pale ground-colour and the brown transverse fasciae, very different from the uniform colouring of *vernetensis*. These second-brood specimens, named *autumnalis* by Turati, occur not only on the plains. In certain places they are found also at a considerable altitude, and I have examples from Monte Generoso taken at 1500 m.

This form may be considered a modification of the *orientalpestris* of the eastern Alps. It stands in the same relation to this form of *hebe* as does *vernetensis* to *diamina*, and there is little doubt that it is a climatic form. Its maximum development is reached only in a few localities such as Alserio and Reazzino, where normal specimens are uncommon, but elsewhere in Italy there is a strong tendency towards the development of *wheeleri*. In most districts melanic examples are common, and they become increasingly frequent as the elevation increases, until at about 3000 ft. the paler specimens disappear and only the dark and single-brooded *orientalpestris* remains. Intermediate forms occur, and one from Chiusa has been named *isarcica* by Verity.

The distribution of *wheeleri* with *orientalpestris* and transitional forms is imperfectly known at present. They are found certainly in many localities in northern Italy, in the Bergamasker Alps and in Carniola, but not in the main Alpine chain. They may probably occur also in the Dolomites at relatively low levels.

Localities :—Reazzino; Alserio (transitional forms from Turin and Milan); second-brood specimens of this form from above localities and also from Monte Generoso, 1200 m., and Mendrisio, 16 June 1919 (? error of date). From Mendel Pass also probably of this form but the date not known.

Note on *Melitaea britomartis* Assmann.

In the absence of the typical male specimen it is impossible now to identify this insect with certainty. A careful study of the description has convinced me that Lederer and later Meyer-Dür were right in referring it to *diamina hebe* (*dictynna* auct.). In particular I would draw attention to the following passages :—

"... die ersten Binde [of the under surface of the hind-wings] liegt dicht an der Wurzel und wird nur am Vorderrand durch einen Fleck der Grundfarbe davon getrennt." A pale lunule proximal to the precostal nervure is usually conspicuous in *hebe*. It is often present also in members of the *athalia–aurelia* group, but so narrow and obscured by dark hair that it cannot be seen without special care.

"... der Raum zwischen der ersten und zweiten Binde besteht aus 4 Flecken ... der vierte ist beständig blasser als die übrigen, meist weisslich."

In *hebe* the pale macule at the base of cellule 2 is commonly white and paler than the others of the series. This is not the case in the *athalia* group.

" Zwischen der zweiten und dritten Binde . . . der neunte Fleck des nach aussen gelegenen Theils ist ebenfalls heller als die übrigen." This also corresponds well with *hebe*, in which the discal macule in cellule 1b, as also that in 2, are often conspicuously pale.

" Der hinter der dritten Binde liegenden Theil der Grundfarbe wird von dem Aussenrände durch eine feine, demselben parallel laufende schwarze Linie getrennt, der Raum zwischen dieser und dem Aussenrände ist beständig dunkler, die Farbe bleibt sich indess nicht gleich, sie richtet sie vielmehr nach der mehr oder minder dunklen Anlage der drei zimmetbraunen Binden." This refers to the brown terminal line which is present along the outer margin of the hind-wings in *diamina hebe*, and which is conspicuous in this butterfly. It does occur also in some forms of *aureliaeformis* Vrty.

The description given of the larva fits very well with Freyer's figure in 1840, *N. Beitr. SchmettK.* **4** : 49. The date of appearance will do well for *hebe*, which is one of the earliest Melitaeid butterflies to fly.

Prittwitz discusses *britomartis* very fully in 1861, *Stettin. ent. Ztg* **22** : 194. In this paper he states that *dictynna* does not occur in Schlesien. It is possible therefore that he and Assmann knew this insect only from figures, or from a few specimens, and failed to recognise fresh specimens. The insect certainly occurs in Schlesien and near Breslau, but it is local and uncommon in the district. The name has been referred by Verity to a form of *aureliaeformis*, but this insect has not been taken in northern Europe, nor is it an inhabitant of the European decidual forest zone, to which the district near Breslau belongs. In my opinion there is no justification for identifying *britomartis* with *aureliaeformis*, nor do I consider it at all likely that that insect ever will be discovered in Schlesien.

Melitaea diamina mod. ***protomedia*** Mén. Pl. 12 fig. 11 ♂.

Mel. protomedia Ménétriés, 1858, *Bull. Ac. St. Pétersb.* **17** : 214. Loc. Lower Amur; 1859, *in* Schrenk *Reise Amurlande* : 23.

Fore-wing 20–22 mm.

Along the Amur river and in the province of Ussuri, *M. diamina* is variable. Many examples are rather small and strongly coloured on the under surface, often indistinguishable from those taken in Germany, Austria and Carniola. There is a tendency for the orange marks on the upper surface to increase in size. Such examples closely resemble western specimens transitional to *wheeleri*; they appear to be common and widely distributed. The full development of this tendency appears in the form *protomedia* Mén., in which insect there is a definite departure from the facies of European forms. The fore-wing shows angulation of the outer margin opposite nervure 5. On the upper surface the wing-pattern is very complete. On the under surface the ground-colour of the hind-wings is generally uniform yellow with the transverse fasciae bright chestnut brown. As a rule the sexes are similar, but female specimens are common which show the usual pearly-white macules on the under surface of the hind-wings. Ménétriés figures a male with this marking, but I have not yet seen such a specimen.

The larva and pupa resemble those of *diamina* (1909, Seitz, *Grossschmett. Erde* **1** : 224).

This may be looked upon as an extreme development of the *wheeleri* modifi-

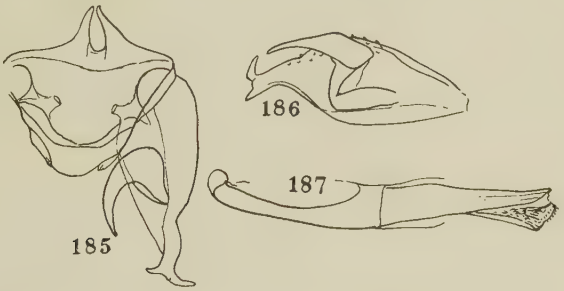
cation, showing characters transitional to the subsp. *regama* described below, with which *protomedia* is often confused. There are few specimens of this form in English collections, and all I have seen are labelled "Amur" without further indication of locality. From the localities given in Ménétriés' original description it is not improbable that the form has a relatively restricted distribution on the lower reaches of the Amur and possibly also in Ussuri, where true *diamina* approaches the distribution area of *regama* Fruhst.

Melitaea diamina regama Fruhst. Pl. 13 fig. 7 ♂.

Mel. protomedia regama Fruhstorfer, 1915, *Soc. Ent.* **30** : 58. Loc. Chang-Yang, West China.
Mel. protomedia Fixen, 1887, *nec* Mén., *in* Romanoff *Mém. Lépid.* **3** : 298; Leech, 1892, *Butt. China, Japan and Corea,* **1** : 216.

Exp. alar. 45–50 mm.

In this striking form the fore-wings are angled on the outer margin opposite nervure 5. The ground-colour on the upper surface is yellowish, the markings rather fine and very complete and distinct right up to the wing bases. There is no dark shading in cellule 1 of



Figs. 185–187.—*Melitaea diamina regama* Fruhstorfer. 185. Male genitalia, dorsal view. Changyang, China; 186. Clasp, lateral view; 187. Penis, lateral view.

the hind-wings. On the under surface the disc of the fore-wing is pale orange with paler yellow macules near the tip. Except for the strong costal bar of the discal fascia the dark markings are not heavy. The hind-wings are yellow, the transverse markings brown. The basal transverse fascia is often very narrow and broken, sometimes scarcely visible. The submarginal lunules are very large. The double terminal line of both wings is rather darker than the ground-colour.

The female resembles the male, but may be a little larger. On the under surface the pale macules may be silvery white (ab. *argentea* Fixn. *loc. cit.* : 301), as is often the case in normal *diamina*. This beautiful form is noted as being common in Corea, but Leech says he saw only one specimen from China.

Genitalia. The male genitalia (fig. 185) differ slightly from those of the typical form. The harpe is heavier and the central tooth is usually missing from the terminal process of the clasp (fig. 186) which therefore appears to be bifid. The penis (fig. 187) shows no obvious difference.

Distribution. It is clear that this form should be given subspecific status. The insect appears to be common in Corea, and occurs again in China much farther to the south. The extent of the distribution farther north towards the Amur is yet unknown, but it is likely that it soon passes into true *protomedia* in this direction. Between Corea and the habitat in central China there is a wide area round Pekin from which there are no records. I have lately seen

some specimens from the main island of Japan. This distribution is characteristic of the unusually well-marked faunistic area in the extreme east of Asia.

This form is often referred to *protomedia* Ménét. but wrongly, and many authors appear to have realised that the insect did not altogether agree with the figures and description given by Ménétriés.

Localities :—Corea : Pungting, 4 July; Fusan, June; Gensan, June. China : near Changyang, 6000 ft. (near Ichang), ex coll. Pratt, many specimens ; Wychang. Japan : Mt. Daisen, Prov. Hoki, 7 July 1920, six specimens leg. I. Sugitani.

The following forms of *Melitaea diamina* have been described and named :—

aduaticana *M. dictynna aduaticana* Cabeau, 1903, *Rev. Mens. Soc. ent. Namur.* **3** : 38. Loc. Florennes, Belgium. The wings and pattern distorted. On the upper surface the post-discal orange macules are fused into fasciae. Below the black basal macules are exaggerated on the hind-wings. *Cf. athalia tectensis* Cabeau.

albida *M. dictynna* ab. ♀ *albida* H. Skala, 1910, *Int. ent. Z.* **3** : 229. Loc. Elgg, nr. Zurich. The ground-colour of the upper surface is all yellowish-white.

alpestris *M. dictynna alpestris* Fruhstorfer, 1917, *Arch. Naturg.* **82** (A) (2) : 14. Loc. Engadin. On the under surface the colours are less vivid. See p. 315.

amaura *M. dictynna* ab. *amaura* Schawerda, 1919, *Z. österr. ent. Ver.* **4** : 67. Loc. Austria. Strongly washed with dark brown on the upper surface.

aurelita *M. dictynna aurelita* Fruhstorfer, ? 1918, *Arch. Naturg.* **83** (A) (6) : 12. Loc. Alserio, Lombardy. On the upper surface the orange macules of the hind-wings are extended. Cf. *wheeleri* Chpm. ; *briantea* Trti. ; see p. 318.

autumnalis *M. dictynna briantea* gen. 2 *autumnalis* Turati, 1920, *Nat. Sicil.* **23** : 233. Loc. Alserio, Lombardy. The smaller and paler summer generation.

briantea *M. dictynna briantea* Turati, 1920, *Nat. Sicil.* **23** : 232. Loc. Alserio, Lombardy. An *athalia*-like form with bright orange ground-colour and large macules. See p. 318.

britomartis *M. britomartis* Assmann, 1847, *Z. Ent. Breslau* **1847** : 2, 39. See p. 319.

candidata *M. dictynna* Esp. *candidata* H. Stauder, 1922, *Ent. Anz.* **2** : 44. Specimens in which the macules on the upper surface of the hind-wings are white.

codinai *M. diamina codinai* de Sagarra, 1932, *Butll. Inst. Catal. Hist. nat.* **10** : 115. Loc. Tortosa, N. Spain. The upper surface is pale, and the black pattern reduced. An extreme development of *vernetensis* Rond.

confluens *M. dictynna* ab. *confluens* Maslowscy, 1923, *Polsk. Pismo Ent.* **2** : 126. (fig.). Loc. Not given. The median white macules are obliterated on the under surface of the hind-wing.

corythalioides *M. dictynna* ab. *corythalioides* Spannring, 1922, *Verh. zool.-bot. Ges. Wien.* **72** : 8. Loc. Salzburg. Resembles the *corythalia* form of *athalia*. The pattern is largely obliterated on the disc of the fore-wings, and the hind-wings are black except for the submarginal spots.

erycina *M. erycina* Lederer, 1853, *Verh. zool.-bot. Ges. Wien.* **3** : 357. Loc. Altai Mountains. Above darker than usual, with pale yellow macules. A small form. See p. 317.

erycinides *M. dictynna* var. *erycinides* Staudinger, 1892, *Deuts. ent. Z.* "*Iris*" **5** : 326. Loc. Kentei Mountains. Slightly darker than most European specimens, and the markings on the under surface of the hind-wings a deeper brown. Staudinger *in* 1901, *Catalog* says "*vix nominanda.*"

fasciata *M. dictynna* ab. *fasciata* Lambillion, 1906, *Rev. Mens. Soc. ent. Namur* **6** : 47. Loc. Hertogenwald. On the fore-wing the median and post-discal fasciae are united into a wide transverse band.

grammani *M. dictynna* ab. *grammani* Vorbrodt, 1914, *Schmett. Schweiz* **2** : 610. Loc. Elgg. The submarginal points on the under surface of the hind-wings are represented by small circles.

isarcica *M. diamina isarcica* Verity, 1931, *Ent. Rec.* **43** : 68. Loc. Klausen, Tirol. A large, bright form.

johni *M. dictynna* ab. *johni* Stauder, 1922, *Ent. Anz.* **2** : 44. Loc. Salzkammergut. Rather unicolorous and dull. The spots small and dark, the outer macules scarcely visible.

learchus *M. dictynna* hybr. *learchus* H. Ebert, 1926, *Deuts. ent. Z.* "*Iris*" **40** : 31. Loc. Allgau. On the under surface of the hind-wings the usual submarginal ocelli are scarcely visible. Described as hybrid *athalia* × *dictynna*. There is no evidence that this is so.

lebedevi *M. dictynna lebedevi* Obratsov, 1936, *Festschrift E. Strand.* **1** : 641. Loc. Cherson; S. Russia. A melanic form with the orange macules reduced.

luciferina *M. dictynna* ab. *luciferina* Agenjo, 1934, *Eos, Madrid* **9** : 116. Loc. Huesca, Spain. A very melanic specimen corresponding to *athalia pyronia* Hubn.

magnaclara *M. diamina magnaclara* Verity, 1931, *Ent. Rec.* **43** : 68. Loc. Valdieri, Maritime Alps. A rather large and pale form, transitional to *vernetensis* Rondou.

magnobscura *M. diamina magnobscura* Verity, 1931, *Ent. Rec.* **43** : 80. Loc. Gironde. Rather a large form, the orange pattern on the upper surface extended.

melicerta *M. melicerta* Pfützner, 1873, *Berlin. ent. Z.* **17** : 159. Appears very unstable from the description, and seems to be a mixture of specimens of *athalia* and *diamina*. Redescribed (!) by Ebert in 1926, *Deuts. ent. Z.* "*Iris*" **40** : 29, and placed by him as hybr. *athalia* ♂ × *diamina* ♀. There seems little evidence of this.

moffartsi *M. dictynna* ab. *moffartsi* Lambillion, 1919, *Rev. Mens. Soc. ent. Namur.* **19** : 35. Loc. Belgium, Bouillon. The under surface without marks on the disc of the fore-wings, and no black macules at the base of the hind-wings.

orientalpestris *M. diamina orientalpestris* Verity, 1931, *Ent. Rec.* **43** : 81. Loc. Sappada, Carnic Alps. A small form with the under surface very bright brown. See p. 318.

perrhoio *M. dictynna* ab. *perrhoio* Reverdin, 1926, *Bull. Soc. lép. Genève* **5** : 175. Loc. Valais. Markings on the under surface obsolete, on the upper surface obscure on the fore-wings.

postwheeleri *M. diamina postwheeleri* Verity, 1930, *Ent. Rec.* **42** : 108. Loc. Reazzino. A name for the second generation of *wheeleri* Chapman.

praxilla *M. dictynna praxilla* Fruhstorfer, 1917, *Arch. Naturg.* **82** (A) (2) : 13. Loc. Laibach. A large and richly coloured form.

pyrenaealpestris *M. diamina pyrenaealpestris* Verity, 1930, *Ent. Rec.* **43** : 70. Loc. Gedre. Varies from normal specimens to *vernetensis* Rondou.

semidetrita *M. dictynna* ab. *semidetrita* Hartig, 1924, *Ent. Rundsch.* **41** : 42. Loc. Tscherms.

semilearchus *M. dictynna* v. *semilearchus* Ebert, 1926, *Deuts. ent. Z. "Iris"* **40** : 31. Loc. Allgau. The under surface of the hind-wings paler than normal, the eye-spots lacking the usual dark scales.

seminigra *M. dictynna* ab. *seminigra* Muschamp, 1905, *Bull. Soc. lép. Genève* **1** : 70. Loc. Campolungo. Posterior wings entirely black above. This is a common form in high mountains.

siberica *M. dictynna* var. *siberica* Stgr., 1871, *Cat.* (Ed. 2) : 9. Included as a synonym of *erycina* Led. (Appears first in the *Cat.* (Ed. 1) as *nom. nud.*) Preocc. by *artemis siberica* Stgr., 1861.

subtus-ocellata *M. dictynna* ab. *subtus-ocellata* Reverdin, 1914, *Bull. Soc. lép. Genève* **3** : 35 (fig.). Loc. Isère, France. On the upper surface of the fore-wing the pattern is obsolete on the disc; below the discal fascia is distorted into rings.

trifasciata *M. dictynna trifasciata* Gusic, 1917, *Glasn. Hrvat. prirod. Drustva, Zagreb* **1917** : 216. Loc. Croatia, Kostajnica. Above very dark, with only two rows of red-brown macules and four macules at the wing-bases. The black pattern on the under surface greatly extended. Many specimens.

vacua *M. dictynna* ab. *vacua* Cabeau, 1922, *Rev. Mens. Soc. ent. Namur.* **22** : 45. Loc. Belgium, Theux. On the upper surface of the fore-wings the median and post-median black marks are wanting in cellules 2 and 3.

variegata *M. dictynna briantea* gen. 2 *autumnalis* forma *variegata* Turati, 1920, *Nat. Sicil.* **23** : 233. A modification which shows the orange and yellow contrast on the upper surface.

vernetensis *M. dictynna* var. *vernetensis* Rondou, 1902, *Actes Soc. Linn. Bordeaux* **57** : 24. Loc. Vernet-les-Bains. Pale specimens with diminished black markings. See p. 316.

wheeleri *M. dictynna* var. *wheeleri* Chapman, 1910, *Ent. Rec.* **22** : 71. Loc. Reazzino. An *athalia*-like form, with vivid colours on the under surface. Cf. *aurelita* Fruhst. and *briantea* Turati. See p. 318.

c. ***phoebe*** Group. Distribution Map 7, p. 188.

1. *Melitaea phoebe* W.V.
2. *Melitaea scotosia* Butler.
3. *Melitaea aetherie* Hübner.
4. *Melitaea sibina* Alpheraky.
5. *Melitaea collina* Lederer.
6. *Melitaea turkmanica* Higgins.
7. *Melitaea consulis* Wiltshire.

Group characters. A close relationship is obvious from the similar wing-markings of the seven species which form this group. The species are usually above the common size, and include the largest known Melitaeid butterflies. The larger species are all much alike.

The submarginal lunule on the upper surface, in cellule 3 of the fore-wing, is often greatly enlarged. A close connection with the *cinxia* group is apparent in the regular and linear markings, and especially in the frequent development of black spots in the submarginal macules of the hind-wing. The palpus is long, the middle joint slightly dilated distally, unlike the palpus in *cinxia*. The male fore tarsus is relatively large, showing three distinct joints as a rule.

The male genitalia are distinctive. They are relatively small, compact and short.

The saccus is very deeply notched, the clasp short and truncated, the posterior processes short and stout. The harpe is always very strong and without teeth. A small, well-formed condyle appears in *collina*, *consulis* and *turkmanica*, but in the other members there is only a strong boss. The penis posterior to the suspensory ligament is short. It terminates in an apex, which is scarcely, if at all, upturned. A prominent morula is present. The female genitalia are large, and the specific characters are well developed. There is again a marked similarity to *cinxia*. The bacillus is forked, usually slender, but wide and heavy in *aetherie* and *collina*. The auricles are large and meet in the mid-line to overhang and conceal the ostium. The bursa, certainly not a simple ovoid, appears to be bilobed or trifid in *phoebe* and *scotosia*.

Two broods are known to appear in the case of *phoebe* and *aetherie*, in suitable localities. The larva of *phoebe* is well known, and has been illustrated by several authors. The food-plant in northern Europe is said to be chiefly *Centaurea*.

Unfortunately it has not been possible to make a proper study of *collina*, as there is so little material, and the female of *turkmanica* is unknown. It is probable that these are both isolated forms, with restricted habitats, showing primitive characters. The three species *phoebe*, *scotosia* and *sibina* are exceptionally interesting. This appears to be a group of three vicariant forms, of specific status, which occupy respectively the Eur-Asiatic, the eastern Siberian and the central Asiatic regions. Indeed *M. sibina* is the only vicariant of a Eur-Asiatic Melitaeid species which is known to occur in central Asia, where it appears in the mountains from the Pamirs northwards through the Thian-Shan to the Altai. The well-known *M. phoebe* has an enormous distribution from the Atlantic across the temperate regions, but does not quite reach the Pacific. Its place is taken in the extreme east and in Japan by *M. scotosia*. Flying with forms of *phoebe* in the western Mediterranean is found *aetherie*, which occurs as far east as Sicily. The three remaining species are smaller and approach *cinxia* more closely. *M. collina* is confined to Syria, *M. turkmanica* is only known from Transcaspia, and *M. consulis*, another closely allied insect, has lately been described by Wiltshire from Shiraz in southern Persia. These three species are very closely allied, and compose a small group peculiar to Syria and Persia, which demonstrates the known faunistic relationship between these countries.

34. ***MELITAEA PHOEBE*** W.V. Plate 14 fig. 7 ♀. Distribution Map 7.

Pap. phoebe, 1775, *Verz. Schmett. Wien. Gegend* : 179. Loc. Vienna.
Pap. corythallia Esper, 1780, *Die Schmetterlinge* **1** (2) : 67. No locality.
Pap. paedotrophos Bergstrasser, 1780, *Nomencl. Ins.* **4** : 14. Loc. Hanau (Hesse).
Pap. tremulae Piller and Mitterpacher, 1783, *Iter Poseganum* : 69. Loc. Slavonia.

Distribution. The geographical distribution of *M. phoebe* corresponds closely with that of *didyma* and of *cinxia*. It is often found in warm and stony places, and in Europe is commonest in the south. In the west of France it is found up to 50° north latitude (Rennes and Chartres), and has been recorded locally on the north coast of Brittany (Cooke, 1924, *Entomologist* **57** : 221). I can find no record from Flanders or Belgium, but in Germany it is locally common in the south, and penetrates farther north in places, for example in the Harz mountains and near Berlin. Towards the east, as is the case with *didyma*, the range extends farther northwards, and in the west of Russia it probably attains the 55 parallel, but records are difficult to find and actual specimens from that country do not exist in England. According to Erschoff, it occurs

across all Russia and western Siberia. South of the 50 parallel the species becomes increasingly common, and it is one of the most abundant butterflies in the southern Alps and along the north Mediterranean littoral. In north Africa, it is local and uncommon in Morocco and Algeria, where it flies in the mountain ravines and stony hillsides. It is generally distributed in Asia Minor, and extends through Syria to Jerusalem which forms the southern limit of its range in that region. Farther east it is found in Armenia and in Persia on Mount Shahkuh, but appears less common there than *didyma* or *cinxia*. It is recorded by Christoph from the Achal Tekke as a rare insect (1884, *in* Romanoff, *Mém. Lépid.* **1** : 104), and I have specimens from Transcaspia and from Aulie Ata in the Syr Darya district of Turkestan. Unlike *didyma* the species does not reach the Ferghana valley, and its place is taken in the Alai Mountains and the southern Thian-Shan by the closely related *M. sibina*. North of this *phoebe* occurs in the Alexander Mountains and in the northern Thian-Shan near the lake Issyk-kul. I have a specimen from the neighbouring valley of the Aksu and it is recorded by Wagner (1913, *Ent. Mitt.* **2** : 88) from Sary Dschas north of the Chan-Tengri Massif. This is especially interesting as it must come into close relationship in this region with the vicarious species *sibina*. North of Dzungaria the butterfly becomes much more frequent, and it seems to be common in the Altai, Changai, Kentei and neighbouring ranges. The Siberian distribution certainly includes the upper reaches of the Amur river, and at this point it may be associated with the eastern vicariant *scotosia*. It has been taken, also, around Lake Baical, and towards the north-east the range extends along the Vitim and Vilui rivers, in the direction of Shigansk as far certainly as the 65° north latitude (Herz, 1898, *Deuts. ent. Z.* "*Iris*" **11** : 240). It is interesting to recall that *didyma polaris* and *cinxia* all show the same remarkable extension of distribution towards the Arctic circle at this point. Farther south the species occurs again in the Chinese province of Chi-li. There also it comes into close relationship with *scotosia*, although it is not known whether the two forms actually fly in the same districts. It is, perhaps, unlikely that the distribution extends across the Gobi from the Changai Mountains, more probably it spreads from the Amur basin down the Khingan Mountains through Manchuria to China, but unfortunately there is no material available to support this suggestion.

Variation. Very beautiful and apparently confusing variation occurs in this species. There is certainly some evidence of variation of a geographical (*i.e.* subspecific) type, but the most obvious variable factors cannot be analysed on a geographical basis. On the other hand, there can be no doubt that several of these factors are influenced by environment (climate etc.) to give rise to *formae tempestatis*, and they can best be analysed from this point of view. In this connection it is interesting to compare the reaction under similar conditions of *phoebe* with *didyma* and other related species, and fortunately this is possible as in many cases they fly together. In most cases it will be found that the variable factors are influenced in the same direction in all species by a given environment. When this can be demonstrated I feel it is evidence that the change in question is not truly geographical but rather seasonal, and that the form resulting should not be classed as a subspecies. The chief variable factors are as follows :—

1. Size.
2. Tone of ground-colour.
3. Development of the black markings on the upper surface.
4. Development of contrasting colours on the upper surface.

These can be considered separately in this order :—

1. The size diminishes at the limits of the distribution area. This may be due to food scarcity, short feeding period or similar cause. It is easy to understand that the insect might become undersized at the point where life became barely possible. The small size is marked at the northern and southern limits of the distribution zone, and is rather less obvious at the vertical limit at extreme elevations in mountains. There is no corresponding diminution in size at the eastern and western limits. The small forms referred to are found in Algeria (*punica* Ob.), southern Syria (*telona* Fruhst.), also in southern Italy and Sicily. The corresponding forms of *didyma* from Syria and western Asia generally are also small (*dalmatina* Stgr.) and the Algerian *didyma mauretanica* is typically below normal size. In the eastern Mediterranean the small *dalmatina* are accompanied, where they occur, by small *phoebe* (*ogygia* Fruhst.), but larger races of both species occur in this region. In Syria too is found the small *trivia pseudodidyma* Rebel, a very small form of this species, flying with the little *montium* Belter, both of which occur with *phoebe telona* at Beirut. It is clear, therefore, that some factor, possibly a hot and dry climate, is present in Algeria, Syria and neighbouring countries, which produces small insects. In the north the reduced size is obvious in specimens from northern Europe generally. I have examples from Germany and also from the Champagne district of France which are distinctly below normal size. A short series from the Urals is no larger than *telona* from Beirut, while in the Lena district of Siberia, the north-eastern limit of the distribution, the specimens described by Herz must be among the smallest known forms (*tungusa* Herz). At moderate altitudes in the southern Alps the insect reaches a large size, but in the Engadin, where it is found at great elevations over 6000 ft., the form (*minoa* Fruhst.) is definitely smaller. It is there associated with the little *didyma alpina* Stgr., found at the extreme limit in altitude of the distribution of the species. The small size of most high Alpine insects is well known, and I think this must often be an effect of the environment. Probably the same explanation may be given for the small size of the second-brood specimens which occur in many warm localities. These are always smaller than the first brood in all species of *Melitaea* in which they are known to occur, including *didyma*, *diamina*, *trivia*, *parthenoides* and *deione*. In the case of *phoebe* the second-brood specimens which fly in the south of Italy (*pauper* Vrty) show strong likeness to the small and pale specimens of Asia Minor, which suggests that in both cases the same factors may combine to produce the modification in the facies. While the smallest specimens are produced by the extremes of heat and cold, the largest examples are found in warm mountainous localities. I have already mentioned the large specimens, which fly in the southern European Alps and in the Balkans. The species reaches the same large size in parts of southern Russia (Sarepta), in the Caucasus, the Altai and other mountains of eastern Siberia and in western China (*mandarina* Seitz). In these localities the species is usually single brooded, and the large size is probably a natural reaction to an abundant food-supply and a leisurely development in good climatic conditions. Analogous reaction in other species is found in the *trivia* (*fascelis*) of Sarepta, the largest known form of this species, and the very large *didymoides pekinensis* Seitz which occurs with *phoebe mandarina* in China. It seems likely, therefore, that size varies in the same direction in all species under similar environmental conditions. Consequently it is not a suitable criterion to use in separating subspecies.

2. The tone of the ground-colour varies from a pale sandy-yellow to dark

chestnut red. The influence of climate is very obvious. In hot and dry southern countries the ground-colour is pale, and the hotter the paler. Especially light examples are found in southern Italy, in Sicily (*emipunica* Vrty), in Greece (*ogygia* Fruhst.), Algeria and through all Asia Minor and western Asia generally. Many of these forms are small, but not all. I have referred above to the small *phoebe* which occurs in Algeria, Sicily, parts of Greece and southern Syria, always associated with a pale ground-colour. In many parts of Asia Minor, in Turkestan, Transcaspia and Persia, the specimens are of normal size, but as a rule these are not so pale in tone as the smaller examples. I have already pointed out that the same reaction to hot and dry conditions appears in the pale ground-colour of nearly all desert species, for example *dodgsoni*, *deserticola* and *acreina* (p. 201). Pale colour and small size are so often related in southern specimens that there is clearly some common factor producing these modifications, which must depend upon ecological conditions. An analogous (climatic) influence is also clearly seen in the pale colour of the second-brood specimens of hot localities, which may approach the extreme forms of the driest districts. In this case there can be little doubt that the modification is a reaction to climatic conditions, and the specimens are often so unlike those of the first brood that the difference is confusing. Small size and pale ground-colour are characteristic of second-brood specimens in *phoebe*, *didyma*, *trivia* and *diamina* and several other species. Turning now to the northern range, the ground-colour is often rather pale and cold orange-yellow. In the females especially the ground may be almost white but largely obscured by dark shading. In the central districts of Europe, particularly in the southern Alps, the ground becomes bright tawny orange, often very brilliant. Such specimens have been often named, and they are found also in the central mountainous districts right across the distribution area, in the Caucasus (*ottonis* Fruhst.), the Changai Mountains (*changaica* Seitz), the Altai (*saturata* Stgr.) etc. These differ only in minor details and will be considered later when the named forms are described. The rich tone of the upper surface in mountain specimens is apparent in many species. It is well marked in *didyma*, and reference has been made (p. 206) to the brilliant races taken in Algeria in the Djebel Aures (*interposita* Roths.) and in mountains of Asia Minor (*variabilis* Belter), both of which occur in districts where small and pale specimens are more usual. The character of colour is indeed more capricious than any other, and there may be marked differences in specimens taken only a few miles apart. In Greece, for instance, Staudinger recorded a large and fiery form (*ottonis* Fruhst.) from the Veluchi, while in other places he met a form like ordinary German examples. In some hot districts a smaller and paler form has been found (*ogygia* Fruhst. from Poros) which is similar to specimens from Asia Minor. The same contradictory development is found in the Caucasus. No doubt the perception of the sudden variation led Verity (1919, *Ent. Rec.* **31** : 182) to remark : " This species, like the preceding, produces very marked individual, seasonal and geographical variation, but in this case the races do not form groups corresponding to their distribution ; they are local, and even the extreme types may be found in localities not far apart." In my opinion such variation must be regarded as seasonal or at least ecological in origin. A large number of subspecies has been established with the tone of the ground-colour as the chief character. It will be seen that this is not a good criterion of true geographical variation.

3. Obliteration or accentuation of the spots and striae on the upper surface is very common. As a rule the post-discal lunules on the fore-wings and the

discal markings on the hind-wings are the first to disappear. Specimens in which this tendency is well marked may be referred to *aetherea* Eversm. (Pl. 14). The name was suggested for examples of this kind from southern Russia. It is often employed in a subspecific sense for the race of Sarepta, of which there are many specimens in museums. A number of specimens from this locality do not show *aetherea* characters, but the modification has a very wide distribution and is commonly seen in specimens from southern Europe and west Asia. Such southern examples may be of normal size, and the pattern though thin is nearly or quite complete (*ogygia* Fruhst.); in others the modification is carried further and the post-discal markings are mostly obsolete. This feature is often found constantly in the extreme south, and in second-brood specimens, associated with small size and pale ground-colour. In such races (e.g. *pauper* Vrty; *telona* Fruhst.) an ecological factor is very obvious. In warm regions where the heat is not extreme, the feature is inconstant and usually less well marked, but it is well seen in specimens from central Italy (*tusca* Vrty), Sarepta where the variability is great, the Changai, Alexander and other Asiatic mountains. There the size is often large and the ground-colour bright orange-red. On the other hand, in northern and Alpine regions very dark specimens appear, and the accentuation of the black pattern appears to be associated with the dark ground-colour and large size often found in these localities. In all cases the female is more often heavily marked than the male, as is the case in all related species. In *phoebe* such large dark specimens are best referred to *ottonis* Fruhst. The darkest specimens I have seen are from the mountains of Bulgaria and northern Spain. I believe that dampness is an important factor in producing this modification, which is well developed in most specimens from the Caucasus, Altai, Kentei and other Siberian mountains. Corresponding variation occurs throughout the group, and in the case of *didyma* has been already fully described (p. 204). I may recall the development on Mount Veluchi in Greece of *didyma graeca* Stgr. with *phoebe ottonis* Fruhst., each representing the most heavily marked known form of the respective species, while in the hot and low-lying coastal districts of the same country occur the small and pale *phoebe ogygia* Fruhst. and pale weakly marked *didyma* forms near *dalmatina* Stgr. Clearly the three factors so far considered are related, and, as a rule, the variation north and south may be indicated by a scheme as follows :—

North : small, dark, heavily marked.
large, dark, heavily marked.
large, pale, lightly marked.
South : small, pale, lightly marked.

In a general sense this scheme of variation applies to all Melitaeid species.

4. The very striking factor of colour contrast differs from the characters just mentioned. It is produced by the paler yellow ground-colour of the macules in the discoidal cell, the post-discal macules and often the submarginal lunules, while the submarginal fascia of both wings may remain a darker reddish-orange. The feature appears here and there throughout the tribe, it is easily perceptible, and therefore of special interest in such a variable group. It is especially common in the genus *Euphydryas*, where it may appear constantly in both sexes (*maturna*, *iduna*), or in the male only as a constant feature (*cynthia*). In *chitralensis* and in some forms of *arcesia* it occurs in the female, and in this sex it appears occasionally in various species. It may be a prominent character only in certain subspecies, as in *aurinia*, where the contrast is particularly striking in *aurinia glaciegenita* Vrty. In this species the feature

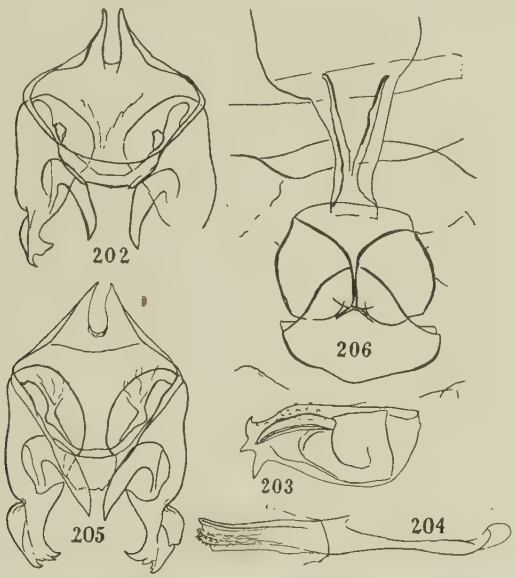
appears commonly in western forms, particularly those from the north, including Scotland and Ireland. The distribution of forms showing marked colour contrast suggests that cold or damp climate is favourable to the development of this character. In *phoebe* the position is unusual, and the occurrence of marked contrast in both northern and southern forms produces the two well-marked varieties known respectively as *ornata* Christoph and *occitanica* Stgr. This nomenclature unfortunately obscures the essential similarity of the colour characters of the two forms, in which, however, the black pattern is reduced in the latter and extended in the former. It is clear that the cline of colour contrast is independent of the cline of melanism. The northern *ornata* (Plate 14 fig. 10) is small with heavy and complete black markings. Such specimens occur from the Urals, from Lake Baical, the Caucasus, Germany and northern France. They probably occur throughout the northern distribution area of the species, always associated with more normal examples of the typical form. In larger specimens it appears in races of the *ottonis* series, principally in the females, which I have from Greece and Bulgaria. The southern form *occitanica* (Plate 14 fig. 11) has a sandy yellow ground-colour and fine but complete black markings on the upper surface. As a rule the specimens are a good deal larger than *ornata*. In Europe the colour contrast first appears commonly in the southern Swiss Alps, and it becomes increasingly well developed and more constant in southern France. In the eastern Pyrenees it predominates, and from there it spreads through Spain where the most striking and beautiful forms occur, although even in Andalusia more normal specimens appear, especially at high altitudes. Elsewhere the modification is less marked, but it appears often in the central distribution area. It is not uncommon near Sarepta, and an example, probably from this locality, is well figured by Eversmann (1851, *in* Fischer, *Entomogr. Imp. Ross.* **5**: Pl. IX figs. 5 and 6). It appears also in specimens from the Altai, Kentei and Sajan Mountains, in some of these well marked, but always less bright than in Spanish examples, and in the Sajan at least already transitional to *ornata*. Farther south the modification rather suddenly ceases to appear. It is absent from North Africa, from Peninsular Italy and from Asia Minor, where only pale and " dry " forms occur. Only in Transcaspia have I seen a race which shows at the same time marked *aetherea* modification of a true southern form and obvious colour contrast. Such specimens, described below as *enoch*, are figured on Plate 14 fig. 4.

This short account is sufficient to indicate that in different species contrast colours may represent specific or subspecific character, they may be a sexual character of the male or female, or they may appear as a rare aberration. Such a distribution of a recurring character in a group suggests an ancient derivation, and no doubt interesting genetic relations which might be worked out. Like many atavistic characters it is especially prone to appear in the female sex. On the other hand, there may be also some climatic control, and the contrast is commonest in races from moist and cold climates or from high altitudes, or in species which live in such climates. It is commonly associated with that exaggeration of the black markings which so often appears in cold and damp surroundings. In the case of *phoebe* the gradual increase in colour contrast met with in Europe passing from east to west is so striking, that I feel the Spanish *occitanica* must be treated as a subspecies. The development of this form in Spain is really remarkable, as elsewhere in a similar environment only small forms with pale ground-colour appear. Consideration of the distribution suggests that this form is not controlled by the same factors which determine size, tone of ground-colour and extent of the black markings.

Fore-wing 20–24 mm. ♂ and ♀.

It is scarcely necessary to give a full description of this well-known species.

On the upper surface the ground-colour is orange, the usual markings regular and complete. On the fore-wings a conspicuous feature is present in the large submarginal lunule in cellule 3, which displaces the post-discal series basally, so that in this cellule it nearly touches the discal macules. On the hind-wing the body groove is pale. The submarginal fascia is usually complete from cellule 1c to 6 and it is composed of a series of macules of a slightly darker tone than the discal area. These macules often show central black points (ab. *cinxioides* Musch.). On the under surface of the fore-wing the discal series is generally well marked, and there is often a heavy black shading internal to the pale submarginal lunule in cellule 2. The markings of the hind-wing are not distinctive. In



Figs. 202–206.—*Melitaea phoebe* W.V. 202. Male genitalia, dorsal view. Berisal, Switzerland; 203. Clasp, lateral view. Berisal; 204. Penis, lateral view. Berisal; 205. Male genitalia, dorsal view. Transcaspia; 206. Female genitalia, dorsal view. Piedmont.

the female, which is usually larger than the male, the markings are most variable. As a rule the ground-colour on the upper surface is pale yellowish while the black markings are extended, particularly at the wing-bases. Some specimens are very melanic, but in southern specimens the male colouring commonly appears. The *cinxioides* form is most frequent in the female.

The male genitalia are small for the size of the insect (fig. 202). The ringwall is short, not grooved, with a large and deep saccus. The condyle is represented by a heavy boss. The tegumen is wide and short. The clasp (fig. 203) is oval, truncated posteriorly and ending in a wide tridentate expansion. The harpe is strong and without teeth. The penis (fig. 204) is slightly upturned at the apex, with a well-marked morula. The female genitalia (fig. 206) are very characteristic. There is a wide flattened cone from which arises the base of the bifid bacillus. The auricles are large and overhang the well-cut, lozenge-shaped scutum. The fundus of the bursa copulatrix appears to be divided symmetrically by a shallow longitudinal groove.

The egg does not appear to be properly described. The greyish larva is well known. The butterfly appears in May or June. It is double-brooded except in the northern part of its range.

Variation and distribution. The Austrian form, originally described by Schiffermuller, was specified as typical by Verity (1928, *Ent. Rec.* **40** : 161). The specimens are rather small as a rule, the ground-colour on the upper surface somewhat pale, and without the fiery reddish tinge which appears in so many alpine races farther south. The black markings are uniform and complete, often with extensive black shading at the wing-bases. The *cinxioides* modification is very common, and there is a marked tendency to melanism in both sexes, which is often exaggerated in the female. The race is rather featureless and not well characterised. It is generally distributed in northern and eastern Europe and appears again at a corresponding longitude in Siberia. I have specimens from Germany, Austria and Hungary, and the same form occurs in northern Switzerland and extends southwards through the Engadin, where it occurs at great altitudes. Examples from this locality have been named *minoa* by Fruhstorfer, but I cannot separate them from the typical form. Localities given by Fruhstorfer in his description of *minoa* include Wiesbaden, Linz, Mahren and Agram. At Pontresina I have taken this form at 6000 ft. Examples from Innsbruck described as *canellina* by Stauder cannot be separated from Bavarian specimens (Osthelder) and this name can be treated as a synonym of *phoebe*. In some northern districts, notably in Hungary, a second brood is developed, specimens of which are a good deal paler and smaller than usual. Farther south in Italy (Aspromonte), at a considerable altitude, the species is strongly modified in the direction of these northern specimens, and it appears in a smallish form *totila* Stauder, with heavy black markings, scarcely separable from the typical form. The development of this " wet " form is surprising in a district where much paler and very different specimens are found at lower levels. Material from Siberia is scarce, but a good series in the Tring Museum from Lake Baical correspond very well with typical *phoebe*. They are labelled *tungusa* Herz, but are not really small enough for this form in its full development. In northern France the species is commonly less melanic. These small northern forms may develop marked colour contrast (*ornata* Christoph, Pl. 14 fig. 10). This form was described from the south Urals, but some specimens from there cannot be distinguished from German and even French examples.

Distribution. The following localities will indicate the main features of the species distribution :—Europe : widely distributed up to the 50° N. lat. Commoner in the south. Africa : in mountainous regions in Algeria and Morocco. Occurs here only in the subspecies *punica* Ob. Western Asia : in Asia Minor and Syria, common as far south as Jerusalem and Transjordan (Petra). Iraq, no records; Persia, Demavend and Shahkuh; Shiraz, the most southerly locality. Central Asia : Turkestan, Aulie Ata; Syr Darya; Musert, Tekkes Valley; Transcaspia, reported scarce; Arwas; Askhabad; Jablonowka, Achal Tekke, 2000 m., July; Alexander Mountains; Dzungarian Ala Tau (Wagner). Siberia : Changai Mountains, large form; Altai Mountains; Kentei Mountains; Sajan Mountains; Lake Baical district; Pokrowka, Raddefka; Transbaicalia; Pompejefka (Little Kingan Mountains); Vitim and Vilui rivers (Herz); Tjutju-Ho, 400 km. north of Vladivostok. China : Chi-li Province, Kalgan; Chi-feng-hsien.

Melitaea phoebe mod. ***ottonis*** Fruhst. Pl. 14 fig. 1.

Mel. phoebe var. *caucasica* Staudinger, 1870, *Hor. Soc. ent. Ross.* **7** : 59. Loc. Armenia and Greece.

Mel. phoebe ottonis Fruhstorfer, 1917, *Arch. Naturg.* **82** (A) (2) : 2. nom. n. pro *phoebe* var. *caucasica* Stgr. 1870 *nec didyma* var. *caucasica* Stgr. 1861.

Mel. phoebe caucasicola Verity, 1919, *Ent. Rec.* **31** : 184. nom. n. pro *phoebe caucasica* Stgr. 1870 *nec didyma caucasica* Stgr. 1861.

In this large form the average length of the fore-wing is about 23 mm. or even more. The ground-colour of the male is rich tawny orange-red on the upper surface, the black markings usually complete and sometimes exaggerated. In the female melanic forms are common. The large size and rich colouring make *ottonis* a handsome insect.

The form was described by Staudinger from Greece and Armenia (Caucasus) but it occurs very generally in mountainous districts and appears to represent the development in moist and favourable localities. It is naturally connected by every grade of transitional form with the typical *phoebe* of the north and with the paler southern races. Very pale and also intermediate forms also occur in Greece, but in suitable localities *ottonis* seems to be widely distributed in the Balkans. I have it from the Rilo Mountains in Bulgaria, and the form *lokris* described by Fruhstorfer from Saratow must be nearly or quite identical. In western Europe I have a series from the Col di Tenda in the Ligurian Appennines which closely resemble this form, but with fewer black macules on the upper surface. In the southern Alps of Switzerland the size remains large and the ground-colour bright, but the markings tend here also to become less prominent except the discal series, which is often enlarged. Attention has been called to this character by Verity in his race *monilata*, and it occurs commonly in mountain races, but is nowhere constant. From the same district the development of the *occitanica* modification with contrast colours was noticed by Seitz, and upon this character he founded his race *alternans*, from Zermatt and elsewhere in the central Alps. These two races can scarcely be separated from one another, but they differ slightly from typical *ottonis* in the combination of enlarged discal spots and *occitanica* characters. It is likely that these features depend upon environment since similar examples appear again in the Altai Mountains (*saturata* Stgr.) and other localities in Siberia. Many specimens from the southern Alps show a tendency to fine and slender markings, and form series transitional to the next form, *changaica* Seitz, often combined with obvious colour contrast. Many local races of this type have been named, including *koios* Fruhstorfer, from Klausen in the southern Tirol. Such specimens cannot be distinguished from many taken in the Alpes Maritimes and described as *virgilia* by Fruhstorfer. In a series from St. Martin Vesubie some males show quite marked diminution of the black pattern, an obvious reaction to hot conditions. This is not so marked in the specimens from the Simplon and Zermatt mentioned above. In my opinion, identical with these and often showing very large discal spots are *sylleion* Fruhstorfer from the Cogne Valley, and *nigroalternans* Verity from Mt. Cenis. It is impossible to maintain such minute differentiation, and in my opinion all these names have the same meaning. They represent forms which are best placed as *ottonis*, often showing characters which are transitional to *occitanica* and to the lighter forms (*changaica*) which appear in warmer countries. If a name is required to cover such forms as occur in the southern Alps, that of *alternans* Seitz seems most suitable. Farther west in central France most specimens are undistinguished, and may be classed as transitional between *ottonis* and the typical form of northern Europe. In the south-east a further transition towards the paler *ogygia* Fruhstorfer has

been described by Fruhstorfer as *narenta*, from Jablanica in Herzegovina. I have such specimens also from eastern Roumelia (Sliven). Another transitional form from the Sajan Mountains has been described by Seitz as *tungana*. My series from this locality are rather smaller than those of the European Alps, with a marked tendency towards colour contrast, features which might be expected in a northerly locality. It is probable that a second brood appears in some forms of the *ottonis* series. Specimens taken in the northern Caucasus in August at Zhelezwovodsk are named *sextilis* by Jachontov. These are smaller, paler and quite unlike the usual mountain form. Still other Caucasian specimens are near *changaica*. It is probable that a variety of racial forms appear in the Caucasus, and in the absence of adequate material it is impossible to attempt their analysis at present. The name may be restricted to the Balkan form described by Staudinger from the Veluchi near Carpinisi, from which some examples from the Caucasus cannot be distinguished.

Melitaea phoebe mod. ***changaica*** Seitz. Pl. 14 fig. 2 ♂, 9 ♀.

M. phoebe changaica Seitz (Bang-Haas *in litt.*), 1909, *Grossschmett. Erde* **1**: 217. Loc. Changai Mts.

Fore-wing ♂ 24–25 mm., ♀ 28 mm.

In this form the ground-colour remains bright orange and the size is large, but the markings are fine and delicate. The discal spots of the fore-wings are not enlarged.

This represents a definite step in the modification of the rather dark and heavily marked mountain forms towards the paler southern races. With *changaica* are usually found examples showing colour contrast (*occitanica* colours), and others showing the *aetherea* modification, of which a well-marked specimen is figured on Plate 14 fig. 9. It occurs typically in the Changai Mountains, where the females are sometimes of large size. With these may be united many specimens from the central range of the species. Most examples from Sarepta are well placed here, and in the extreme east I have seen characteristic forms from Kalgan and Chi-feng-Hsien in Chili, northern China, and from Tjuju-Ho about 400 km. north of Vladivostok, taken in July. These last do not appear to me to differ from the Changai examples except that some of the females are very large, with the fore-wing up to 30 mm. in length, Plate 14 fig. 8. They have been named *mandarina* by Seitz (*loc. cit.*). At Pompejefka, in the Kingan Mountains, a series taken in June is transitional to *ottonis*. In Europe very similar transitional specimens occur among the Alpine foothills, and examples from Maroggia have been named *rovia* by Fruhstorfer. Farther south in central and southern Italy the form is a good deal smaller with a fore-wing of 20–23 mm. (*tusca* Verity). In spite of the small size the name is included here, as in other respects the specimens agree so closely with *changaica*. It is probable that a second brood is commonly developed in the *changaica* series. In peninsular Italy the second generation is very much smaller and the facies is usually so much changed that the form is especially described below as *pauper* Vrty.

Melitaea phoebe gen. 2 ***pauper*** Vrty. Pl. 14 fig. 3 ♂.

M. phoebe pauper Verity, 1919, *Ent. Rec.* **31** : 183 (Oct.). Loc. Florence.

Fore-wing ♂ 17 mm., ♀ 18 mm.

This small form is unlike the bright first generation so widely distributed in central Italy. In the male the fore-wing is often rather pointed, the ground-colour pale, and the black markings fine and reduced, particularly in the post-discal area of the fore-wings.

The reduction in size is the outstanding character, and this appears to vary a good deal in different localities. Although the original description is of Florentine examples, the most extreme specimens seen by me, one of which is now figured, are from Lucca and Naples. In many of these the black pattern is complete, and the *cinxioides* spots are often developed, recalling the heavily marked race recorded from Monte Cocuzzo and the Aspromonte (*totila* Stauder). According to Fruhstorfer, some second-brood specimens are quite brightly coloured, and in the north of Italy the seasonal differences are sufficiently marked to have led him to give the name *autumnalis* to examples of the autumn generation of *rovia* from Monte Generoso, in which the special characters of *pauper* are not fully developed.

It is interesting to notice the very marked differences which are shown by specimens of the second generation in Spain and in Italy, as in both these localities the ecological conditions might be expected to be very similar. In Spain the specimens nearly always show the marked *occitanica* characters of the first brood. In Italy the reduction in size is most striking. At present I know *pauper* only from central and southern Italy, and this form does not appear to develop everywhere. It is probable that in most districts transitional specimens near *autumnalis* occur. These show the wider wings of *tusca*, and a reduction of the black pattern much closer to the Asiatic *telona*.

Melitaea phoebe mod. ***telona*** Fruhst. Pl. 14 fig. 5 ♂.

M. phoebe telona Fruhstorfer, 1907, *Int. ent. Z.* **1** : 310. Loc. Jerusalem.

Fore-wing ♂ 18–21 mm., ♀ 20–23 mm.

This form represents the extreme modification found in hot and dry localities. The specimens are small, with the fore-wing in the male about 18 mm. long. The ground-colour on the upper surface is sandy yellow, the black markings fine and reduced, often absent in the post-discal region especially near the anal angle of the fore-wing. The female resembles the male.

This form, described from Jerusalem, is met with commonly in the hottest localities in southern Syria. Even paler specimens from Transjordan (Petra) have been named *dorae* by Graves, but the distinction is very fine. In many examples the discal spots of the fore-wings are exaggerated. In southern Greece there flies a form in which the ground-colour is uniform pale yellow but the markings are regular and complete although fine. Fruhstorfer has named such specimens *ogygia*, and it is interesting to recall that the largest and darkest form of the species was also described from the same country. The race *ogygia* shows the characters of a dry form, but less extreme than in *telona*. As a rule the specimens are not below normal size and the females are often a little darker than the male, but definite melanism is rare and *occitanica* forms are scarcely ever seen. Similar forms are found over a wide area of Asia Minor and farther east into Turkestan. I have series from Hadjin, Malatia, Akbes, Amasia and Armenia which are really quite indistinguishable from Graecian specimens or from one another. Of these, examples from the Amanus Mountains near Akbes have been named *amanica* by Rebel. This name was founded upon two female specimens and one male. It is probably a true synonym of *ogygia* Fruhst. The same features appear in the first brood of Sicily named by Verity *emipunica*, which to me appear indistinguishable from Syrian specimens. Examples from the Tekkes Valley in Turkestan are similar, but in a short series from Aulie Ata the markings are somewhat bolder. Forms near *telona*

occur also in Persia, and a series from the Demavend are particularly pale. Other examples from Shahkuh are closer to the ordinary form of the European Alps.

Melitaea phoebe occitanica Stgr. Pl. 14 fig. 11 ♀.

M. phoebe var. *occitanica* Staudinger, 1871, *Catalog.* (Ed. 2) : 18. Loc. Iberia (" It." *ex errore*).

Fore-wing ♂ 21–23 mm., ♀ 22–27 mm.

In the first generation this is a form of moderate or rather large size. On the upper surface the black markings are usually complete with the discal spots often emphasised. On the upper surface the ground-colour of the wings is golden yellow, while the basal cellular marks and the submarginal macules are filled with deeper orange-red. On the under surface of the fore-wings the orange ground-colour is of pale tone and the yellow macules are very obvious. As a rule specimens of the second generation are altogether smaller, with the fore-wings about 2 mm. shorter.

This most interesting development has been referred to on page 330. Obvious colour contrast begins to appear in the southern Alps of Switzerland and France, and is widely distributed in south-western Europe, although not found everywhere. In the eastern Pyrenees the modification becomes more constant, and from there it spreads through Spain, to reach its maximum development in Andalusia. Such examples show not only the beautiful contrast of colours on the upper surface, but the black pattern is complete and delicate, not obscured by black shading. This is especially obvious on the hind-wing. The form is well marked in many Spanish localities at low elevations. Elsewhere over a great part of Spain transitional specimens occur, often scarcely separable from those of the eastern Pyrenees. Much darker specimens appear in the mountains, especially in the north, and even in Andalusia the form is not constant at high levels. Attempts have been made to define some Spanish races of intermediate character, but it does not appear to me that these forms are truly distinct, and the names discussed below are of doubtful value. Dr. Verity has suggested (1928, *Ent. Rec.* **39** : 163) that Esper's *corythallia* represents specimens from the Iberic peninsula, and further that the locality of Staudinger's " type " of *occitanica* was Barcelona, which he thinks also the probable place of origin of Esper's specimen. He therefore placed *occitanica* as a synonym of *corythallia*. It is difficult to agree with this course. Although Esper's figures do not suggest the German form, they may have come from France, and in fact it is stated in the text that they represent the original specimens of Geoffroy's *P. cinxia* var. *B.*, which were certainly French. In the second place Fruhstorfer has already specified the typical locality of *occitanica* Stgr. *sensu stricto* as Andalusia (1916, *Arch. Naturg.* **82** (A) (2) : 1), and I think that this specification should stand. Actually Staudinger rarely specified " types." He labelled with the word " *original* " or " *orig.*" the series upon which the descriptions were based, and the specimens often came from several localities. It is certain that many of the original specimens were from Andalusia, and the descriptive " *magis variegata* " certainly applies very well to southern specimens. Esper's *corythallia* may be employed to name the forms transitional to well-developed *occitanica*, which occur not only in Spain but also in southern France (*suboccitanica* Vrty ; *subcorythallia* Vrty). Sagarra's name *bethune-bakeri* probably falls as a synonym to *occitanica*, although six paratypes in my collection come from 1600 m. in the Sierra Nevada, and several do not show the extreme *occitanica* characters found at a lower elevation. In the mountainous districts there is a strong tendency towards melanism. In

northern Spain I found beautiful *occitanica* at Riano on the plain at the southern foot of the Asturias, while high up the pass, in the mountains at 4000 ft., I took examples in which the black pattern is more exaggerated than in any others I have seen, although usually some colour contrast persists. This striking modification, the exact opposite of *aetherea*, is not yet distinguished by a name. It may be conveniently termed **nimbula** mod. n., described from a series of 11 males and 3 females. The typical male specimen is illustrated on Plate 14 fig. 12; it is in my collection.

The small second generation has been named *francescoi* by de Sagarra from Barcelona specimens. I have a short series said to be paratypes, rather smaller than first-brood specimens but not otherwise remarkable. More extreme *occitanica* characters appear in *ornatiformis* de Sagarra, described from Cuenca. I have seen no examples from there, but the description fits a good series from the Sierra de Estrela in Portugal, taken in August at 1000 m. and very bright. These are labelled *estrela* Romei, but I cannot trace a reference to a description, and do not know whether the name was ever published validly. In addition to brightly marked forms there occur others in which the ground-colour on the upper surface is uniform yellowish. These have been described from Lisbon by Fruhstorfer as *gerinia* and from Castille as *guevara*. I have such specimens from Barcelona and from Castille, the latter showing almost no colour contrast, but with the fine and complete black pattern on the upper surface which is so characteristic of *occitanica*. I have not yet seen a series of such specimens from Spain, and I think they are exceptional.

Melitaea phoebe mod. ***enoch*** mod. n. Pl. 14 fig. 4 ♂.

Fore-wing ♂ 22–25 mm., ♀ 20–23 mm.

On the upper surface in the male the ground-colour is sandy-yellow orange. A series of paler yellow macules extends across the wing posterior to the discal spots and a paler spot is present also before the discoidal lunule in both wings. The black markings are not heavy, somewhat irregular and show a tendency to the *aetheria* facies. As a rule the post-discal series of the fore-wing is not quite obsolete but can be seen to be straighter than usual and does not show the approach to the mid-costal bar in cellule 3 which is almost always seen. In the female specimens the black markings are finer and the colour of the wings slightly less bright. The under surface is not remarkable. On the fore-wing the paler yellow macules of the upper surface are faintly indicated.

The contrast colouring in these specimens is not so marked as in Spanish *occitanica*, but may be equivalent to an average specimen from the eastern Pyrenees. The five specimens from Askabad are very uniform, but in two from the locality Jablonowka the black markings are greatly reduced and there is a wide unmarked post-discal field in both. This form makes an unexpected exception to most central Asiatic *phoebe* on account of the appearance of the *occitanica* contrast, and in the reduction of the black markings, both very uncommon features in the warmer regions of Asia. In addition there is a small difference in the male genitalia of two specimens examined, in the heavier and rather differently shaped posterior process of the clasp (fig. 205). It may be that *enoch* should be ranked as a subspecies, but without more extensive material it is not possible to be sure of this.

Localities :—Transcaspia : Arwas (no further data); Askabad (no further data) (type); Jablonowka, Achal Tekke, 2000 m., July.

Melitaea phoebe punica Ob. Pl. 14 fig. 6 ♂.

Mel. phoebe var. *punica* Oberthur, 1876, *Ét. Ent.* **1** : 25. Loc. Lambessa, Algeria.
Mel. punica Oberthur, 1914, *Lép. comp.* **10** : 102.

Fore-wing ♂ 17–20 mm., ♀ 20–23 mm.

This is typically a form of small size. On the upper surface the ground-colour is pale, a yellowish orange, with little tendency to reddish in the submarginal macules. The pattern is regular and complete. The discal spots in particular are usually represented by a uniform series of black macules across both wings. On the under surface the discal spots of the fore-wings are relatively large. On the hind-wings the ground-colour is white, sometimes lustrous, the markings fine and delicate. The female is usually slightly larger than the male. The colour and markings are similar. In both sexes the genitalia appear to me to be indistinguishable from those of typical *phoebe*.

Oberthur looked upon *punica* as a distinct species. While this may be difficult to justify, it should certainly be ranked as a well-differentiated subspecies, very different from those modifications previously described. Small differences difficult to describe produce an alteration in facies, best seen in the large female figured on Pl. 15 fig. 8, which is really striking. The form is very constant and provides the strongest contrast to the Iberian *occitanica*. It occurs throughout Algeria, but is rarely abundant. Rothschild noted that it is commoner in the eastern province of Constantine, and grows scarcer in the west. Larger specimens with the fore-wing up to 22 mm. are not rare. From Morocco I have specimens taken by Ellison in the Middle Atlas which are a little larger than most Algerian examples, with a darker orange ground-colour. Even larger specimens from Mogador have been named *leechi* by Rothschild (May 1917, *Nov. Zool.* **24** : 99) from a very uniform series of about 12 female specimens in the British Museum. The name of this striking form is preoccupied by *leechi* Alph. 1895, and is replaced by *gaisericus* Hemming, 1941. No type was specified at the time, and the ♀ lectotype is now illustrated on Pl. 15 fig. 8. I have seen this very large form from other localities in the west and south-west, but never from Algeria. Some interesting notes on the habits of this insect are made by H. Powell (1914, *in* Oberthur, *Lép. comp.* **10** : 103). It is said to haunt small ravines or hills from the end of April to early June. In some localities and in some years a second emergence may appear in July and August. The plant *Rhapontium acaule* which is common in its habitats is suggested as the food-plant in Algeria.

Localities :—Algeria : Lambessa, Khenchela, Batna, Ain Agrab, Sebdou, Geryville, Aflou, Setif. Morocco : Azrou, Mrassine, Haute-Reraya, 1800 m., June, Tedders, Timhadit, Tarseft Pass. Grand Atlas : Mogador (*leechi* Rothsch.), Lake Ifni, 2 June 1927 (*Talbot*), Imarera. Spanish Morocco : Katama and Assila near Marruecos, July.

The following forms of *Melitaea phoebe* have been described and named :—

aetherea *M. phoebe* var. *aetherea* Eversmann, 1851, *in* Fischer, *Entomogr. Imp. Ross.* **5** : 73. Loc. Southern Russia. Like the type, but the black pattern diminishing.

aethereaeformis *M. phoebe aethereaeformis* Verity, 1919, *Ent. Rec.* **31** : 183. Individual specimens of the first brood of central Italy which are exactly like *aetherea* Ev. of southern Russia.

alatauica *M. phoebe alatauica* Wagner, 1913, *Ent. Mitt.* **2** : 89 (fig.). Loc. Issyk-kul—Ili Mountains. Ground-colour dark, with black submarginal

spots on the hind-wings. Under surface of the hind-wings white, with black spots heavy. Described from three male specimens. Probably referable to *sibina* Alph. The name is preoccupied; see *wagneri* Wnu.

albina *M. phoebe* ab. *albina* Verity, 1904, *Entomologist* **37** : 54. Loc. Lucca. The ground-colour of the right-hind wings is yellowish-white.

almana *M. phoebe almana* Rebel, referred to in Seitz, 1909, *Grossschmett. Erde Suppl.* **1** : 208. The original reference cannot be traced. Said to be synonymous with *telona* Fruhst.

alternans *M. phoebe alternans* Seitz, 1909, *Grossschmett. Erde* **1** : 216. Loc. Zermatt. A variegated form proceeding to *occitanica* Stgr., often with enlarged discal spots on the upper surface of the fore-wings.

amanica *M. phoebe amanica* Rebel, 1917, *Sitzb. k. Akad. Wiss. Wien* **126** : 252. Loc. Amanus Mountains. Described from two specimens. Ground-colour rather pale, the black pattern well developed.

autumnalis *M. phoebe rovia* forma *autumnalis* Fruhst., 1919, *Arch. Naturg.* **83** (A) (3) : 169. Loc. Italy, between Brione and Contra. A name for the second generation of *rovia* Fruhst. Differs little from *emipauper* Vrty 1919.

baccata *M. phoebe* ab. *baccata* Delahaye, 1909, *Cat. Lep. Maine. et Loire Suppl.* This work is not available to me for reference.

bethune-bakeri *M. phoebe* Kn. rassa *bethune-bakeri* de Sagarra, 1926, *Butl. Inst. Catalan Hist. nat.* **5/6** : 130. Loc. Sierra Nevada, June 1925. The colouring more intense than in Barcelona specimens. On the fore-wing the submarginal macules quadrangular instead of triangular. Probably synonymous with *occitanica* Stgr.

canellina *M. phoebe canellina* Stauder, 1922, *Ent. Z. Frankfurt* **36** : 18. Loc. Innsbruck. A dark form resembling *minoa* Fruhst. and probably synonymous.

caucasica *M. phoebe* var. *caucasica* Stgr., 1870, *Hor. Soc. ent. ross.* **7** : 59 (fig.). Loc. Armenia and Greece. A large and dark form. Name preocc. by *M. didyma caucasica* Stgr. 1861. See *ottonis* Fruhst. 1916 and *caucasicola* Vrty 1919.

caucasicola *M. phoebe caucasicola* Verity, 1919, *Ent. Rec.* **31** : 184. Loc. New name for *phoebe caucasica* Stgr. 1870 *nec didyma caucasica* Stgr. 1861.

changaica *M. phoebe changaica* Seitz, 1909, *Grossschmett. Erde* **1** : 217. Loc. Changai Mountains. Very large specimens, especially the females. See p. 334.

cinxioides *M. phoebe* ab. *cinxioides* Muschamp, 1905, *Bull. Soc. lép. Genève* **1** : 69 (fig.). Loc. Switzerland. Black spots in the submarginal fascia of hind-wing. (Verity, 1919, *Ent. Rec.* **31** : 183 named this form again with the same name.)

confusa *M. phoebe* Knoch ab. *confusa* Oberthur, 1908, *Bull. Soc. ent. Fr.* **1908** : 45. Loc. Vannes. Discal transverse black lines nearly obliterated. Hind-wing dark at the base.

crassenigra *M. phoebe crassenigra* Verity, 1928, *Ent. Rec.* **40** : 162. Loc. Gironde—Le Rozier. An *occitanica* form with the black discal spots very heavy.

deleta *M. phoebe* form *deleta* Verity, 1919, *Ent. Rec.* **31** : 184. Female of *tusca* in which nearly all the black marking is obliterated.

dorae *M. phoebe dorae* Graves, 1925, *Trans. ent. Soc. Lond.* **1925** : 100. Loc. Transjordan. Small and pale, with the black markings fine and partly obsolete.

emipauper *M. phoebe emipauper* Verity, 1919, *Ent. Rec.* **31** : 183. Loc. Tuscany. A name for specimens of the second brood of *tusca* Vrty which are less extreme and small than those named *pauper* in the same article. Perhaps same as *autumnalis* Fruhst. 1919.

emipunica *M. phoebe emipunica* Vrty, 1919, *Ent. Rec.* **31** : 184. Loc. Sicily—Palermo. The ground-colour pale, the markings fine but complete. The females suffused with greenish at wing bases. Compared with *punica* Ob. by Verity, but all the Sicilian specimens I have seen have been very near pale Grecian examples (*ogygia* Fruhst.) and quite unlike *punica*. Probably *punicata* Turati is a synonym.

fasciata *M. phoebe* Kn. ab. *fasciata* Galvagni, 1934, *Z. österr. ent. Ver.* **19** : 2. Pattern quite abnormal and aberrant. Upper surface mostly black, on the fore-wing the discal macules radially elongated and intense black. Loc. Aust. Inf.

francescoi *M. phoebe* Kn. rassa *occitanica* Stgr. 2-gen. *francescoi* Sagarra, 1926, *Butl. Inst. Catalan Hist. nat.* **5/6** : 130. Loc. Catalonia—Vilamajor, July/Aug. Size small, black macules few and fine, no black suffusion at the hind-wing bases.

gaisericus *M. phoebe gaisericus* nom. n. pro *M. phoebe leechi* Rothsch. 1917 *nec* Alph. 1895, Hemming, 1941, *Proc. R. ent. Soc. Lond.* (B) **10** : 207.

galliaemontium *M. phoebe galliaemontium* Verity, 1928, *Ent. Rec.* **40** : 162. Loc. Mont Dore. Small specimens of the second brood, with the wing-bases heavily shaded with black on the upper surface.

gerinia *M. phoebe gerinia* Fruhstorfer, 1916, *Arch. Naturg.* **82** (A) (2) : 1. Loc. Portugal—Lisbon. The ground-colour uniform orange-yellow without contrast of red. The discocellular spot of the fore-wing large.

geyeri *M. phoebe geyeri* ab. ♂ Abafi-Aigner, 1906, *Ent. Z. Guben* **19** : 208. Loc. Hungary. Markings of the fore-wings strongly reduced. The hind-wings almost black.

guevara *M. phoebe guevara* Fruhst., 1917, *Soc. Ent.* **32** : 19. Loc. Spain—Castille. The ground-colour pale yellowish, the black markings thin and diminished on both surfaces. See *bethune-bakeri* Sagarra.

gurtleri *M. phoebe* ab. *gurtleri* Jonkl, 1908, *Časopis* **5** : 97. Diagnosis in Czech.

koios *M. phoebe koios* Fruhst., 1908 *Int. ent. Z. Guben* **2** : 194. Loc. Klausen. The size is large and the upper surface rather dark in tone. The submarginal region pale and wide.

leechi *M. phoebe leechi* Rothschild, 1917, *Nov. Zool.* **24** : 99. Loc. Mogador. Large (female) specimens of the *punica* type. See p. 338. The name is invalid, and replaced by *menelik* Higgins.

lokris *M. phoebe lokris* Fruhstorfer, 1908, *Int. ent. Z. Guben* **2** : 194. Loc. Saratow. On the upper surface the black pattern is more extensive than in *ottonis*.

malvida *M. phoebe malvida* Fruhst. Referred to in Seitz, *Grossschmett. Erde Suppl.* **1** : 207, from Bosnia. No other reference can be traced.

mandarina *M. phoebe mandarina* Seitz, 1909, *Grossschmett. Erde* **1** : 217. Loc. Mongolia. A very large form, doubtfully separable from *changaica*. See p. 334.

melanina *M. phoebe* var. *melanina* Bonaparte, 1831, *Antologia* : 125. The upper surface normal. On the under surface of the hind-wings the pale yellow ground-colour on the disc and the submarginal lunules are black (red-brown in the figure).

minoa *M. phoebe minoa* Fruhst. 1917, *Arch. Naturg.* **82** (A) (2) : 2. Loc. Engadin. A small and dark race of high levels possibly identical with the name-form. See p. 332.

minor *M. phoebe* ab. *minor* Frey, 1903, *in* Wheeler, *Butt. Switzerland* : 84. I am unable to trace the original reference and it is possible that Wheeler is the author of the name. The name is for specimens of 38 mm. or less expansion. It is preoccupied by *arcesia minor* Elwes, 1899.

monilata *M. phoebe monilata* Verity, 1919, *Ent. Rec.* **31** : 184. Loc. Switzerland—Wallis. A large luxuriant form, the discal row of black spots on the upper surface of the fore-wings enlarged.

monilataeformis *M. phoebe monilataeformis* Verity, 1919, *Ent. Rec.* **31** : 184. Loc. Tuscany. A name for specimens of *tusca* Vrty in which *monilata* characters appear.

narenta *M. phoebe narenta* Fruhst., 1917, *Arch. Naturg.* **82** (A) (2) : 1 (fig.). Loc. Herzegovina—Jablanica. A large and dark race, probably identical with *ottonis* Fruhst. See p. 334.

nigroalternans *M. phoebe nigroalternans* Verity, 1919, *Ent. Rec.* **31** : 184. Loc. Mont Cenis. Resembles *alternans* Seitz, but the black pattern is more extensive.

occitanica *M. phoebe* var. *occitanica* Stgr. 1871, *Cat.* (Ed. 2) : 18. Loc. " It." (Italy ?). The name appears first in the 1861, *Cat.* with the locality Ib. (Iberia), but no description. The same locality is given in the 3rd edition, 1901. It is probable that " It." of the 2nd edit. is a misprint for " Ib.", and it is so taken by all authors. See p. 336.

ogygia *M. phoebe ogygia* Fruhst., 1908, *Int. ent. Z. Guben* **1** : 310. Loc. Greece—Poros. The ground-colour pale and the black markings fine.

ornata *M. phoebe* var. *ornata* Christoph, 1893, *Deuts. ent. Z.* " *Iris* " **6** : 87. Loc. Southern Urals. On the upper surface the macules vary, white and red. The under surface is whitish. See p. 330.

ornatiformis *M. phoebe* Schiff. *ornatiformis* (gen. aestiva) de Sagarra, 1932, *Butl. Inst. Catal. Hist. nat.* **10** : 114. Closely resembles *ornata* Christ. but under surface of hind-wings yellowish and not white.

ottonis *M. phoebe ottonis* Fruhst., 1916, *Arch. Naturg.* **82** (A) (2) : 1. Loc. Caucasus. Nom. n. pro *caucasica* Stgr. *nec M. didyma caucasica* Stgr. 1861.

parascotosia *M. phoebe* subsp. *parascotosia* Collier, 1933, *Ent. Rundsch.* **50** : 54. Exp. 57 mm. The upper surface lighter and the black pattern less extensive below. Described from a single female. Probably referable to *scotosia*. Loc. Sutschan.

parva *M. phoebe* var. *parva* Caradja, 1895, *Deuts. ent. Z.* " *Iris* " **8** : 47. Loc. Bucharest. A small and brightly marked form of the first generation. This is unknown to me.

pauper *M. phoebe pauper* Verity, 1919, *Ent. Rec.* **31** : 183. Loc. Florence. A small form with pale ground-colour and weak black markings. The normal second brood of *tusca* Vrty. See p. 334.

phoebina *M. phoebe phoebina* Turati, 1920, *Nat. Sicil.* **23** : 222. Loc. Aspromonte Mountains. A small mountain form rather dark and heavily marked. Probably identical with *totila* Stauder 1914.

punica *M. phoebe* var. *punica* Oberthur, 1876, *Étud. Ent.* **1** : 25. Loc. Lambessa, Algeria (*M. punica* Oberth., 1914, *Ét. Lép. comp.* **10** : 102). The small and pale subspecies of northern Africa. See p. 338.

punica-powelli *M. phoebe punica-powelli* Oberthur, 1915, *Et. Lép. comp.* **10** ;

fig. 2338. Loc. Algeria. A specimen of *punica* in which the black markings are partly obsolete.

punicata *M. phoebe* forma *punicata* Ragusa, 1920, *Nat. Sicil.* **23** : 150. Loc. Sicily. A small pale form, but the markings well developed. See *emipunica* Vrty.

rostagnoi *M. phoebe rostagnoi* Turati, 1920, *Nat. Sicil.* **23** : 223. Loc. Rome. A small second generation with reduced black pattern on the upper surface. Probably synonymous with *emipauper* Vrty and *autumnalis* Fruhst.

rovia *M. phoebe rovia* Fruhst., 1919, *Arch. Naturg.* **83** (A) (3) : 169. Loc. Monte Generoso. A low level form with weak black markings.

rubrofasciata *M. phoebe* forma *rubrofasciata* Gusic, 1922, *N. Beitr. syst. InsectK.* **2** : 95. Loc. Zagreb. A small example with the black pattern deficient on the wing discs.

saturata *M. phoebe* var. *saturata* Stgr., 1892, *Deuts. ent. Z.* " *Iris* " **5** : 323. Loc. Kentei Mountains. A large and brightly coloured form with large black spots. It resembles many mountain races. See p. 333.

seminigra *M. phoebe* ab. *seminigra* Delahaye, 1909, *Cat. Lep. Maine et Loire Suppl.* Not checked, as the work is not available to me for reference.

sextilis *M. phoebe* var. *sextilis* Jachontev, 1909, *Rev. russe Ent.* **8** : 285. Loc. North Caucasus. Small form taken in August, probably second generation. See p. 334.

sterlineata *M. phoebe rostagnoi sterlineata* Turati, 1920, *Nat. Sicil.* **23** : 223. Aberrant female with partial suppression of the pattern across the disc of fore-wings. Similar examples of *aurinia* and *cinxia* with the same name.

subcorythallia *M. phoebe subcorythallia* Verity, 1928, *Ent. Rec.* **40** : 162. Loc. France—Vendée. Transitional to *occitanica* Stgr. The " second generation of France."

suboccitanica *M. phoebe suboccitanica* Verity, 1928, *Ent. Rec.* **40** : 162. Loc. France—Vendée. Very similar to *occitanica* Stgr. The " first generation of France."

sylleion *M. phoebe sylleion* Fruhst., 1917, *Arch. Naturg.* **82** (A) (2) : 2. Loc. Piedmont—Cogne. Ground-colour of the fore-wings darker than in *alternans* Seitz, and with no colour contrast. My specimens suggest that these characters are inconstant. *Vix nominanda.*

tartara *M. phoebe tartara* Krulikowski, 1891, *Bull. Soc. Nat. Moscou* (N.S.) **4** : 236. Loc. Casan. An example in which there is a double black line across both wings parallel to the outer margin.

telona *M. phoebe telona* Fruhst., 1907, *Int. ent. Z.* **1** : 310. Loc. Jerusalem. Small and pale with the black markings reduced. See p. 335.

totila *M. phoebe* forma *totila* Stauder, 1914, *Z. wiss. InsectenB.* **10** : 373. Loc. Italy—Mont Cocuzzo. A small and dark female with marked *cinxioides* spots. Later named *phoebina* by Turati.

tungana *M. phoebe tungana* Seitz, 1909, *Grossschmett. Erde* **1** : 216. Loc. Sajan Mountains. Very melanic examples are described. My specimens suggest that the characters are not constant in the Sajan Mountains, and many are close to *monilata* Vrty and other alpine specimens. See p. 334.

tungusa *M. phoebe* var. *tungusa* Herz, 1898, *Deuts. ent. Z.* " *Iris* " **11** : 240. Loc. Witim and Vilui Mountains. Rather small and dark specimens. Doubtfully distinct from the typical form. See p. 327.

tusca *M. phoebe tusca* Verity, 1919, *Ent. Rec.* **31** : 183. Loc. Tuscany. The ground-colour bright orange, the black markings reduced. See p. 334.

uclensis *M. phoebe* Kn. var. *occitanica* Stgr. ab. *uclensis* (forma n.) Melcon, 1910, *Bol. Soc. Espan. Hist. nat.* **10** : 219. Loc. Uclo. Specimens in which the black marginal semilunes are separated by red ground-colour from the black marginal line.

ufensis *M. phoebe ufensis* Krulikowski, 1902, *Hor. Soc. ent. ross.* **35** : 555 (nota). Nom. n. pro *M. phoebe uralensis* Krulik. 1897 *nec M. maturna uralensis* Stgr. 1871. Probably a synonym of *phoebe ornata* Stgr.

uralensis *M. phoebe uralensis* Krulikowski, 1897, *Mater. k. poznanyu Fauny i flory Ross. Imp.* : 3. Loc. Gov. of Ufa, East Russia. *nec M. arduinna uralensis* Eversm. 1844. Not checked in the original, which is not available to me.

virgilia *M. phoebe virgilia* Fruhstorfer, 1917, *Arch. Naturg.* **82** (A) (2) : 2. Loc. Alpes Maritimes. A large race, the ground-colour rather pale, and the black markings reduced. My specimens suggest that the characters are not constant.

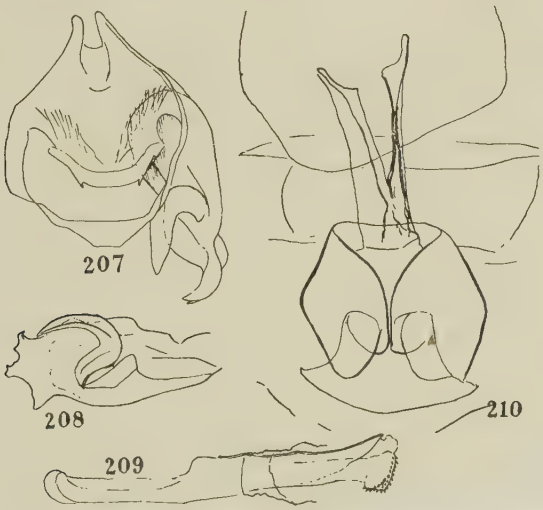
wagneri *M. phoebe wagneri* Wnukowsky, 1929, *Zool. Anz.* **83** : 222. Nom. n. pro *phoebe alatauica* Wagner 1913 *nec M. alatauica* Stgr. 1881.

35. ***MELITAEA SCOTOSIA*** Butl. Pl. 15 fig. 1 ♂, 7 ♀. Distribution Map 7.

Mel. scotosia Butler, 1878, *Cistula Ent.* **2** : 282. Loc. Tokyo, Japan.
Mel. phoebe ab. *yagei* Nire, 1917, *Dobuts. Z. Tokyo* **29** : 145. Loc. Japan.

Fore-wing ♂ and ♀ 25–30 mm.

In the male of this fine species the colouring and wing-markings closely resemble *phoebe*. On the fore-wings the discal spots and the submarginal series are exaggerated.



Figs. 207–210.—*Melitaea scotosia* Butler. 207. Male genitalia, dorsal view. Japan; 208. Clasp, lateral view; 209. Penis, lateral view; 210. Female genitalia, dorsal view. Corea.

On the hind-wing the discal spots are prominent and the orange submarginal lunules form a regular series heavily outlined with black, and often showing a black pupil in the centre of each macule of the submarginal fascia. On the under surface of the hind-wings the discal spots and the black lunules bordering the orange submarginal fascia are very distinct and

other markings are firm and clear-cut. In many specimens the black submarginal dots are present and make a striking feature. The appearance essentially differs from *phoebe*. The female is usually a little larger than the male, and on the upper surface the colouring is variable; sometimes it resembles the male, but more frequently the ground-colour is paler, while the black markings are more extensive, especially at the wing-bases. Many examples show the suffused *viridescens* form, which may be most intense in some localities. The *cinxioides* modification is more common in the female.

The male genitalia (fig. 207) closely resemble those of *phoebe*, but the following small differences appear to be constant. Seen from above the posterior process of the clasp is heavier in *scotosia*. Seen from the side (fig. 208) the teeth are less regular and not so clean-cut, with several small projections. The penis (fig. 209) probably shows no marked difference. In the female genitalia (fig. 210) the auricles are longer antero-posteriorly and the scutum is narrower, scarcely as wide as the auricles. The fundus of the bursa copulatrix appears to be divided into three lobes. This appearance is constant on three preparations made. It seems to be characteristic and no confusion with *phoebe* should occur.

Distribution. The distribution of this species cannot be indicated with great accuracy owing to the scarcity of material with complete data. It is found on the islands of Hondo and Yezo in Japan and also upon the mainland of Corea in the typical form. From there it spreads northwards along the Ussuri and Amur rivers perhaps as far as 50° north latitude. Specimens are not uncommon bearing the labels Ussuri and Amur, but unhappily without accurate data. The belt inhabited must be relatively narrow at this point, since specimens taken by Graeser at Charborowka on the Amur are reported to be normal *phoebe*. Although the two insects probably overlap there and in northern China, their distribution areas remain essentially distinct. Staudinger reports it from Bikin and Baranowka. West and south of Corea the insect is common near Pekin and certainly widely distributed also in Kansu, but I have not yet seen any specimen from Shansi. The southern specimens are slightly different as a rule (*butleri*) from the Corean form. Since *phoebe* certainly occurs in the Chinese province of Tchili, it is probable that the two species come into close relation there, but with a different habitat. Leech notes that *scotosia* is found in the mountains, and I have many specimens in which the altitude is marked as 6000 to 7000 ft., while *phoebe* occurs at a lower elevation. Available records therefore suggest that on the mainland *scotosia* is distributed from the lower reaches of the Amur through Manchuria and around the eastern borders of the Mongolian deserts as far as the Tsing-ling-shan in Kansu. If a refuge area were provided by Manchuria during the period of Siberian glaciation, then *scotosia* may be taken as a characteristic representative of the early fauna, which has maintained something of its glacial distribution.

Localities :—Japan : Tokyo, no further data. Male holotype in Brit. Mus.; Oiwaki, July; Jesso, northern Japan, no further data. Corea : Gensan, no further data. China : Pekin, Western Mountains (one specimen among many *butleri* and the locality must be considered doubtful); Amur : several specimens, with no further data. Ussuri : Bikin; Baranowka (Staudinger); Sutschanski-Rudnik, July (Wladiwostok occ.).

Melitaea scotosia butleri Higgins. Pl. 15 fig. 2 ♂.

Mel. scotosia butleri Higgins, 1940, *Entomologist* **73** : 53. Loc. Pekin.

This form differs from the type in the absence of the proximal border of the submarginal fascia on the upper surface of the hind-wing. In most specimens the post-discal marks are diminished or absent also on the fore-wing, in particular the spot in cellule 1b near the anal

angle. This leaves a very wide post-discal area of clear orange across both wings, marked only by the darkened nervures. As a rule there is a rather obscure fascia of paler yellowish macules immediately posterior to the discal spots of both wings. On the under surface the spots of the submarginal fascia often show black pupils. This form is almost restricted to the male; I have seen only one female specimen. The genitalia do not differ from typical *scotosia*.

Distribution. Nearly all my male specimens from China and Mongolia are of this form, and in these districts it appears to replace the typical *scotosia* Butl. Exceptions are uncommon, but I have one typical example from Pekin. Farther north the material available is poor and without good data, but it is probable that specimens of both forms occur in the province of Amur. I think it is probable that *butleri* may rank correctly as a subspecies.

Localities :—China : Pekin district. (One specimen is typical *scotosia*). Western Pekin Mountains, Hoang-yong-shan, 2500 m., July. Kansu (east). Hweisi, Tsing-ling-shan, 1500 m., July. Kansu (south). Tsing-schui; Liu-pin-shan, 2000 m., July. Lihsian, Kialing River, 2500 m., June. Tschong, Ngan-shan, 2000 m., July. Shansi. Ta-tsing-shan, 1500 m., July. ?Mongolia : " Mongolia " without further data. ?Amur : " Amur " without further data. Some specimens from here are typical *scotosia*.

Male holotype from Pekin, female allotype from Hoang-yong-shan, both in my collection.

36. ***MELITAEA AETHERIE*** Hb. Pl. 15 fig. 3 ♂, 9 ♀. Distribution Map 7.

Pap. aetherie Hübner, 1826, *Samml. europ. Schmett. Pap.* : 875–878 [No text].

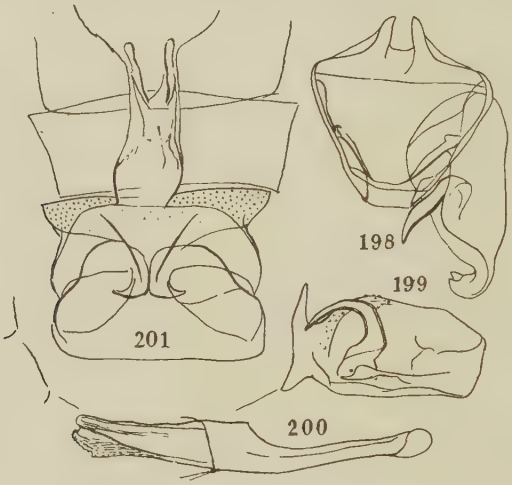
Fore-wing ♂ 22–23 mm., ♀ 23 mm.

In the male on the upper surface the ground-colour is bright fulvous orange. The fore-wings are wide and ample, with the usual markings present at the base. The spots of the discal series are rounded, generally discrete and prominent. The black-edged marginal lunules, of which that in cellule 3 is much enlarged, form a conspicuous series along the outer margin. On the hind-wing the submarginal lunules are the most striking feature, and the markings at the base and on the disc are not much developed. On the under surface of the fore-wings the ground-colour is paler orange, yellow at the tip. Usually the discal spots are prominent but the submarginal lunules are defined only near the costa. On the hind-wings the ground-colour is pale yellow. The wide, brownish submarginal fascia contains a series of exceptionally well-formed red dots. In the female the ground-colour on the upper surface is rather paler. More rarely the black markings are exaggerated and suffused. It is possible that the darker females are commoner in certain localities. On the under surface the ground-colour of the hind-wings is often very pale.

The male genitalia (fig. 198) are short, heavy and well characterised. There is little development of the condyles, which are represented by a strong boss. The clasp (fig. 199) shows close relationship with *phoebe*. The harpe is somewhat slender, and strongly curved in lateral view. Seen in lateral view the posterior process is short but wide, divided into two teeth, of which the longer is directed upwards. Seen from above it is curved strongly medially. The penis (fig. 200) shows a relatively short posterior section. The apex is blunt and not upturned. The morula appears rather hidden by the ample ostium folds.

The female genitalia (fig. 201) show an unusual differentiation of the VIII sternite, which appears somewhat dark and thickened and studded with small pits and hair follicles. The wide bacillus is forked distally for about half its length. The cone is wide and flat. The whole structure is well characterised and shows specific characters.

This butterfly can be confused only with *phoebe*. A formal description is of little value in distinguishing the two, and the markings in fact are almost identical and differ only in degree. Spanish *phoebe* are heavily marked, and *aetherie* differs from them in the scanty markings, particularly on the anterior field of the hind-wings, so that confusion is unlikely. The relationship between these two insects, shown by the genitalia, is not as close as would be expected. On the other hand, a relationship with *collina* is suggested, especially by the female genitalia, which show in both insects a stout bacillus of similar shape.



Figs. 198–201.—*Melitaea aetherie* Hübner. 198. Male genitalia, dorsal view. Spain; 199. Clasp, lateral view; 200. Penis, lateral view; 201. Female genitalia, dorsal view. Algiers.

The butterfly appears in April or May and early June. I can find no notice of a second generation, although this probably occurs. The larva was found by Korb near Chiclana feeding on *Centaurea* but appears not to be described (Ribbe, 1910, *Deuts. ent. Z.* "*Iris*" **23** : 134). The insect is confined to the western Mediterranean, of which it is a characteristic species. It has been recorded in error from southern Russia. The typical form is found at low elevations in southern Spain and Portugal. In Africa the distribution is more extensive, from Morocco to Tunis. The African specimens, described below as *algerica* Ruhl, differ in some unimportant characters which scarcely justify a subspecific status. Still farther east the species appears at Lupo in the Island of Sicily, where it was discovered in 1904 by Kruger.

Localities :—Spain : Cadiz; Chiclana; Jerez de la Frontera. Portugal : Val de Rosal (*Wattison*).

Melitaea aetherie algerica Ruhl. Pl. 15 fig. 4 ♂, 10 ♀.

Mel. aetherie var. *algerica* Ruhl, 1892, *Paläarct. Grossschmett.* : 389. Loc. Lambessa, Algeria.
Mel. aetherie Hubn. var. *perlinii* Turati, 1905, *Nat. Siciliana* **18** : 11. Loc. Palermo, Sicily.

This insect is rather smaller than the Spanish form. The difference is small and inconstant, but quite apparent when good series are compared. In the males the discal spots of the fore-wing are usually less prominent than in the typical form, but the hind-wing is more often marked in the discal area.

Among the females pale androtropic specimens are less common, and when they occur the upper surface is of a paler tone. The majority of specimens are more heavily suffused than any I have seen from Spain. On the under surface of the hind-wings the ground-colour is very pale yellow, sometimes almost white.

The distinction between *algerica* and *aetherie* cannot be maintained in all specimens. The chief difference lies in the smaller size of the former and the greater proportion of suffused females, and this is certainly likely to be an expression of climatic conditions. The Sicilian form, *perlinii* Turati, shows the characters of *algerica* somewhat accentuated. It is still smaller, the ground-colour very bright, the upper surface marked as in *algerica* but the black marginal border of the fore-wing is wider and the submarginal lunules in cellules 2 and 3 of the fore-wings are less deep. In most females the fore-wings are heavily suffused. The two forms are so close that I think they are best united. A majority of specimens are noted as taken in May or early June, and a second generation is recorded by Ragusa from Sicily. The genitalia do not differ from those of the type form. In Africa the insect is widely distributed in Algeria and Morocco. Oberthur says the butterfly is not found in the coastal districts, but on the upland plains it flies at altitudes of 1200 to 1500 m. There is some evidence that the dark females preponderate in Africa only in certain places. For instance, they are almost constant in a series taken at Khenchela, East Algeria, in early May, but in another series from Hammam R'irha only about half are dark. In Morocco the dark form is quite uncommon.

Localities :—Africa : Tunis, no further data (*Oberthur*); Algeria, Constantine province, Oran, Algiers, Ain-Draham, Sebdou, Lambessa, Bainen, Khenchela, etc.; Morocco, Middle Atlas, Azrou, 1800 m., 28 May 1925; Tarzeft Pass, 2200 m., 6 June 1925; Aghbala Larbi, 2100 m., 5 June 1925; Massar Mines, south of Lalla, Marnia, 17 June 1914. Europe : Sicily, Prov. of Palermo, Ficuzza and Lupo, May and early June, again in September (*Ragusa*); Petralia, LaMadonie, 800 to 1100 m., 6 June.

37. ***MELITAEA SIBINA*** Alph. Pl. 15 fig. 6 ♂. Distribution Map 7.

Mel. phoebe Kn. var. *sibina* Alpheraki, 1881, *Hor. Soc. ent. ross.* **16** : 400. Loc. Kouldja—Ili Valley.

Mel. sibina var. *dschungarica* Groum-Grshmailo, 1895, *Hor. Soc. ent. ross.* **29** : 291. Loc. Dschincho in Dzungaria.

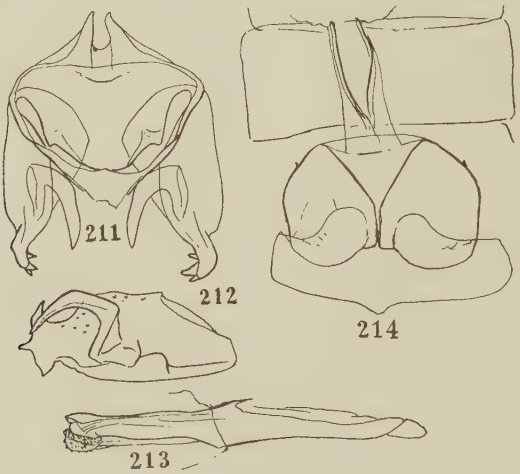
Fore-wing ♂ 20–23 mm., ♀ 23 mm.

This insect so closely resembles *phoebe* that the distinction almost defies analysis although the facies is in fact quite different. On the upper surface in the typical form the ground-colour is rich orange. The black markings are fine and often diminished, in particular the post-discal marks of the fore-wing are often absent. The four discal macules nearest the costa form a straight, even and oblique row. The most striking feature is the double black border along the outer margins of both wings, enclosing large, yellowish submarginal lunules of which that in cellule 3 of the fore-wing is produced basally. Often there are traces of spots in the submarginal fascia of the hind-wing which recall *phoebe cinxioides*. On the under surface of the fore-wing the ground-colour is slightly paler and usually free from markings except the four macules of the costal bar, and the usual marginal lunules. On the hind-wings the resemblance to *phoebe* is very close. The two orange macules of the basal fascia in the cell do not meet below to enclose completely the macule of yellow. The female as a rule is paler (fig. 10), and in many specimens there are pale yellow macules posterior to the discal spots. These are only faintly marked in the specimen

figured. The submarginal lunules are often very large and pale, and the black submarginal spots of the hind-wings may be exaggerated.

These are the characters given for the form *dschungarica* by Groum (1895, *Hor. Soc. ent. ross.* **29** : 291). I have seen the most extreme examples from Kuldja, the locality of the typical form, and another name seems scarcely needed. Similar specimens of both sexes occur in the Alai Mountains. A widely distributed and less variegated form is described below as *rama*.

The male genitalia (fig. 211) closely resemble those of *phoebe*. In lateral view the harpe is more slender and curved in all specimens of *sibina* examined (fig. 212), while the morula



Figs. 211–214.—*Melitaea sibina* Alpheraky. 211. Male genitalia, dorsal view. "Naryn"; 212. Clasp, lateral view; 213. Penis, lateral view; 214. Female genitalia, dorsal view. Kuldja.

of the penis (fig. 213) appears to be more obvious. The latter character will need further confirmation, as a slight protrusion of the eversible membrane makes so much difference. The female genitalia (fig. 214) are better characterised by the wide and shallow scutum.

Distribution. The insect is known from Dzungaria and the northern slopes of the Thian-Shan as far west as the Alexander Mountains. The northern range extends perhaps as far as 45° north latitude. To the south the range extends through the district of "Naryn," whence there are many specimens of the form *rama* without good data in the Oberthur collection. The species appears to be common in the Ferghana valley, and is recorded by Groum from many localities as far west as Samarcand. This author states that it appears on the hills up to 7000 ft. I have seen many examples from the Alai Mountains and Seitz records it flying abundantly on the Kok-Su. The most southern record I can discover is Mark, 2250 m., a village in the Pamirs which I cannot identify (Von Rosen). At least in the southern localities there are two broods each season. According to Groum the first brood in Ferghana is large, from 46 mm. to 54 mm. or even more, in expanse, and this emerges in May. The second brood of July is much smaller, from 39 mm. to 45 mm. It is probable that most of the specimens in British collections are of the second brood, but it

is not possible to find a representative series from any locality with good data. For this reason it is not yet possible to analyse the variations.

Localities :—Dzungaria : Kouldja, no further data; Dschinko (Groum), the form *dzungaria* Gr. ; Alexander Mountains, no further data (Tring, the form *aulicana* Seitz); Kamenja Ritschka, end of May (Wagner, 1913, *Ent. Mitt* **2** : 88); Usek river, end of May; Ferghana, common in many localities (Groum); Alai Mountains, no further data; Kok-Su, very common (Seitz). Pamirs : Mark, 2250 m., 5 July (Von Rosen, 1919, *Mitt. Münch. ent. Ges.* **9** : 83).

Melitaea sibina mod. ***rama*** mod. n. Pl. 15 fig. 5.

In this form the ground-colour is rather darker orange, while on the upper surface the discal series of the fore-wings is usually more or less obliterated. The black marginal border is strongly marked, but the submarginal lunules are not exaggerated and remain of the same tone as the ground-colour. They may disappear in fusion of the double marginal lines (ab. *delunata* Schulz, 1908, *Ent. Z. Stuttgart* **22** : 90). In rare cases the discal marks are absent (ab. *neglecta* Schulz *loc. cit.*). The female closely resembles the male, but as a rule the submarginal lunules are paler.

The male holotype is in the British Museum.

This form occurs with the type in many places, and I have specimens from the Alai Mountains. In some localities it seems to be met with exclusively, and in the Oberthur collection there is a long series all of this type labelled Fort Narine 1907, from which series I have taken the type specimen now illustrated (fig. 5). The form *aulicana* Seitz (Bang-Haas *in litt.* 1909), *Gross-schmett. Erde* **1** : 217 described from the Alexander Mountains, looks from the figure nearly related to *rama*, but the figure does not agree with the description. I do not know the male in nature, but there are in the Tring Museum three females from these mountains which are most striking. The markings are heavy and complete, and there is a strong greenish suffusion. Such colouring might appear in a moist and mountainous locality. I have illustrated one specimen in fig. 11, where it is doubtfully referred to the form *aulicana* Seitz. There is in the British Museum a female from Persia, illustrated in fig. 12. The specimen was collected by E. Funke and the label seems to be quite genuine. This shows very complete but not heavy markings, and may represent an undescribed form, but in the absence of a male example I hesitate to describe it. I have seen no other specimen from this locality. There are in the same collection two specimens labelled " Altai ". These are near *rama*, and I think the locality cannot be accepted without confirmation. It is possibly a mistake for " Alai ".

38. ***MELITAEA COLLINA*** Led. Pl. 11 fig. 1 ♂, 7 ♀. Distribution Map 7.

M. collina Lederer, 1861, *Wien. ent. Monatsch.* **5** : 148, Pl. 1. Loc. Antioch—Syria.

Fore-wing ♂ 16 mm., ♀ 18 mm.

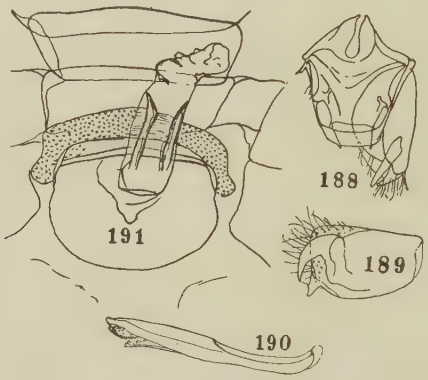
This insect resembles very closely the small forms of *phoebe dorae* Graves which fly with it in Syria. It is easy to separate *collina* by the following characters :—

1. On the upper surface of the fore-wings the submarginal lunules in cellules 2 and 3 are in series with the others and only slightly enlarged. There is no suggestion of the marked enlargement of the lunule in cellule 3 which is present in all forms of *phoebe*.

2. On the under surface of the hind-wings the small black discal spots are placed farther from the basal orange fascia in *collina*, while in *phoebe* the submarginal orange fascia is bordered internally by an extra series of black marks which are usually absent in *collina*.

Genitalia. The genitalia (fig. 188) are small in the male, and the tegumen and ringwall

show the usual characters of the group. The saccus is relatively large and deep, and the condyle is large. The clasp (fig. 189) is short and wide, somewhat rectangular in shape, with a small posterior process directed downwards from the postero-inferior angle. The harpe is large, simple and straight, directed backwards. The penis (fig. 190) shows a definite apex, and the ostium folds and the morula are well developed. It closely resembles the organ in *M. turanica* Ersch. The female genitalia (fig. 191) show a thick and bifid bacillus which recalls that of *aetherie* Hb. Unfortunately the specimen examined was damaged in preparation, and the shape of the cone and auricles cannot be seen. There is on the VIII sternite a narrow collar of thickened chitin of a darker colour, pitted with hair follicles, which embraces the genital plate anteriorly. This also recalls the structure found in *aetherie*.



Figs. 188–191.—*Melitaea collina* Lederer. 188. Male genitalia, dorsal view. Taurus Mts.; 189. Clasp, lateral view. Taurus Mts.; 190. Penis, lateral view. Taurus Mts.; 191. Female genitalia, without antrum and auricles. Taurus Mts.

Distribution etc. This neat and pretty little butterfly has a restricted distribution in Syria and Asia Minor. It appears to be very local and not too common where it occurs. Small specimens of *phoebe* are often identified as *collina*, but in addition to the characters mentioned above, the latter has a delicate and fragile structure difficult to describe, which is not found in the larger insect. One special form has been described as *M. collina* f. *duplicata* Pfeiffer, 1932, *Mitt. Münch. ent. Ges.* **22** : 28. In this the discal spots on the upper surface of the hind-wing are enlarged and more or less confluent.

Localities :—Asia Minor : Taurus, Achyr Dagh, April; Malatia; Marash, May. Syria : Akbes; Beyreuth; Antioch; Bwarij, May 1937 (*Ellison*); Luize, April 1931 (*Ellison*); Palestine, no further data (Oxford Museum).

39. ***MELITAEA TURKMANICA*** Higgins. Pl. 16 fig. 9 ♂. Distribution Map 7.

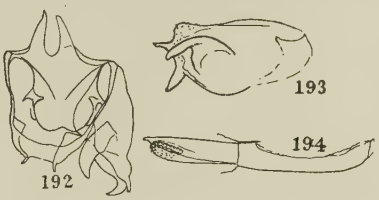
M. turkmanica Higgins, 1940, *Entomologist* **73** : 51.

Fore-wing ♂ 17–18 mm.

The general appearance of this little species suggests a dwarf specimen of *phoebe* W.V. On the upper surface the markings are bold, the ground-colour bright orange. On the fore-wing some yellower shading in the cell and behind the discal spots is present in two specimens. The usual markings are seen in the cell and there is a complete series of conspicuous discal spots, oval near the costa. The post-discal field is unmarked except for a

faint stria in cellule 1b and near the apex of the wing. There is a striking, regular submarginal border of black crescents enclosing the orange lunules, those in cellules 2 and 3 scarcely enlarged. On the hind-wing the black basal suffusion extends on to the body fold. The usual marking is present in the cell and the discal spots appear in the posterior half of the wing. No doubt in some specimens a complete series is developed. The post-discal field is unmarked, the nervures not black. There is a regular border of black crescents and orange lunules similar to that of the fore-wing. On the under surface the markings are similar. On the fore-wings the oval discal spots stand out clearly. The black submarginal crescents are complete but faintly marked. The hind-wings are not distinctive.

The male genitalia (fig. 192) show affinity to those of *collina*. The tegumen of the single specimen examined shows two sharp scaphial projections. The clasp (fig. 193) is distinctive. There are two processes posteriorly. One inferiorly directed downwards recalls *collina*, and above this is another much more slender, which is unfortunately broken in my preparation. The harpe is short, heavy and without teeth. The straight penis (fig. 194) ends in an apex, which is not upturned. There is a large morula.



FIGS. 192–194.—*Melitaea turcmanica* Higgins. 192. Male genitalia, dorsal view. Askhabad; 193. Clasp, lateral view. Posterior superior process broken; 194. Penis, lateral view. Askhabad.

No confusion should occur with this species, which is so well characterised by the large oval discal spots and the regular border of black crescents on both wings. The small size and the clear and unmarked post-discal fields distinguish this butterfly from the closely allied *phoebe* which occurs in the same locality, and which shows in addition a greatly enlarged orange submarginal lunule in cellule 3.

Described from three old but well-preserved male specimens labelled " *casta* Koll. Mai- Askhabad ". These were found in the collection at the Tring Museum, and the labels are of the type used by Staudinger in the last century. There is no indication to suggest how these three specimens arrived in the collection. It is likely that " Askhabad " is used in a wide sense to indicate collecting carried out from this centre. It is hoped that further specimens of this interesting species will be discovered. The type specimen has been placed in the British Museum.

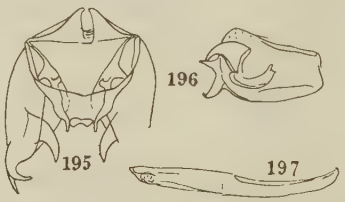
40. ***MELITAEA CONSULIS*** Wiltshire. Pl. 16 fig. 10 ♂.

Mel. consulis Wiltshire, 1941, *J. Bombay nat. Hist. Soc.* **42** : 9.

Fore-wing ♂ 17 mm.

This species has the appearance of a cross between *cinxia* and *trivia* and comes near *collina*. The sexes are only slightly disparate. The male fore-wing the same size and colour as *cinxia amardea* from Kendevan (Elburz), with white chequered fringe, black margin and two parallel chevrons as in *cinxia*. The median band consists of seven heavy black spots, the four nearest the costa being joined, the lower three almost or quite separate, the lowest of all being crescent-shaped, its convex side outwards. Spots nos. 5 and 6 are conspicuous

and oval oblong, not (as in *phoebe*) more lightly indicated than the others. The rest of the fore-wings not unlike that of *phoebe* except that in all but one example the median band consists of a complete series of heavy black spots. The fuscous basal suffusion extends along the whole anal margin, not leaving a pale patch as in *phoebe*. There are no dots between the nervures as in *cinxia* and *arduinna*. From *collina* as illustrated by Osthelder and Pfeiffer, the upperside differences are :—On the fore-wing the nervures are black outwards only from the proximal of the two parallel chevrons, not as in *collina* outwards from the median band. The median spots are much heavier. On the hind-wing there is more space in *collina* between the two parallel chevrons. The underside differences are even greater, but even in the few examples where the hind-wing underside markings can be traced there are no black markings at all on the pale median band. On the underside of the fore-wing the fringes and the marginal area outside the proximal of the two chevrons are suffused with olive-fuscous; it is the proximal, not the submarginal, of the two chevrons that is usually clearly indicated in black. The median band is similarly indicated, corresponding to the upperside. On the hind-wing the markings are obsolescent and the whole wing suffused with olive-fuscous. The female is slightly larger than the male, with a paler ground-colour between the median band and the proximal chevron [E. P. Wiltshire].



Figs. 195–197.—*Melitaea consulis* Wiltshire. 195. Male genitalia, dorsal view. Shiraz; 196. Clasp, lateral view. Shiraz; 197. Penis, lateral view. Shiraz.

The male genitalia (fig. 195) are very much like those of *turkmanica*. The chief distinction is present in the clasp (fig. 196), in which the teeth of the bifid posterior process appear less widely separated in *consulis*, and in lateral view the harpe is heavier. The other features of the genitalia, including the penis (fig. 197), show no noteworthy distinction from *turkmanica*. The female genitalia have not been examined.

This species is common locally in early May at 8000–9000 ft. on a mountain close to Shiraz.

The description given above was written by Mr. Wiltshire and sent to me by him with the single male specimen of *consulis* now figured; in order to make the present work as complete as possible, Mr. Wiltshire has kindly allowed me to publish it.

The facies of this species is striking on account of the pale tone of the under surface. I know it only from a single specimen kindly sent by Mr. Wiltshire, who took it in 1940 with others in a single locality in southern Persia at 8000 ft. near Shiraz. The marking of the upper surface and the form of the male genitalia show the closest relationship to *turkmanica* Higgins, and in spite of the difference in marking of the known specimens it is not yet possible to say with certainty whether the two forms should be treated as subspecies or whether the differentiation is specific, which seems more probable.

The form *casta* Kollar (1848 *Denkschr. Akad. Wiss. Wien* **1** : 5) may be allied to *consulis*.

While this paper was passing through the press I received from Mr. E. P. Wiltshire specimens of an undescribed species from southern Persia. I am

glad of the opportunity of including the description of this insect. I hope to publish an illustration of it later.

41. ***MELITAEA GINA*** sp. n.

Fore-wing ♂ 20–21 mm., ♀ 23 mm.

This is a form of moderate size. In the male, on the upper surface the ground-colour of the wings is bright orange-yellow. On the fore-wing the usual black markings are present in the basal and discal areas. The post-discal spots are only indicated by two obscure macules near the costa. The black submarginal lunules are well developed, almost touching in one specimen, and clearly concave externally. The rounded marginal spots are fused with the narrow terminal line. On the hind-wing the usual black shading does not extend more than half-way down the inner margin. The basal markings are delicately indicated, and in one specimen a few small black points indicate the post-discal series. The black submarginal lunules are thick, strongly lunulate, and very conspicuous, forming a continuous series which fuses with the heavy black terminal line, enclosing the usual orange marginal crescents. On the under surface the ground-colour is slightly paler orange, the hind-wings and the tip of the fore-wings yellow. On the fore-wings the black markings are not heavy. The orange ground-colour extends along the costa and nervures towards the outer margin, and breaks the yellow marginal suffusion into wedge-shaped macules in cellules 2, 3 and 4. On the hind-wing the markings are fine and delicate, resembling those of *M. didyma*. The black markings on the proximal side of the orange submarginal fascia, from the costa to the inner margin, are strongly concave inwards. The black V-mark in cellule lc is nearly midway between the two orange macules, slightly nearer the submarginal fascia. In the female on the upper surface, the ground-colour is pale and the black markings more extensive. The continuous and heavy series of black submarginal lunules forms a conspicuous feature of both wings. On the fore-wing the post-discal series is present and complete, but on the hind-wing it is only well marked posteriorly. On the under surface the colour tones are pale, but the markings resemble the male.

Genitalia. In a single preparation of the male genitalia I am unable to detect any difference from those of *M. didyma*.

The male holotype is in the British Museum.

Identification and distribution. The following features will distinguish *gina* from the closely allied *M. didyma*. On the upper surface the black marginal lunules of the hind-wing form a striking continuous series, which recalls *transcaucasica* and *chitralensis*. Three distinctive characters appear on the under surface. In the first place the yellow apical area extends posteriorly nearly to the anal angle, crossed at the nervures by the orange ground-colour, which extends also along the costa in the male. In *didyma* the yellow suffusion is usually more restricted to the wing-tip and the costa is not orange. Secondly on the hind-wing, there are the distinctive fine concave black striae which form the proximal border of the orange submarginal fascia. In *didyma* these striae are thicker and less regular. Lastly the critical black V-mark in cellule lc is not nearer the discal orange fascia, as it always is in *didyma*-forms. These superficial characters appear to be constant and easily recognised, and I do not feel the insect can be united with *didyma* in spite of the resemblance of the genitalia. The butterfly is referred to as "species No. 6" but without a name, in the paper on *Melitaea* of Iran recently published by Wiltshire in the *J. Bombay nat. Hist. Soc.* The present description is based upon two males and one female recently received from Wiltshire, who says that the form is very localised, but that he has taken it in several localities. The correct status of the insect must remain to some extent *sub judice*, until a more adequate series is available for study.

Localities :—Southern Persia : Kuh-Deeshk, south of Dasht-Arjan, near Shiraz, 30th May, 1941, 8000 ft. (Male type and allotype female now placed in British Museum.) Sineh Safid and Pir-i-Zan, 7000–8000 ft., 1940. Both these localities are in Fars.

Details of localities kindly supplied by Mr. E. P. Wiltshire, who says that the butterfly was taken also on Kuh-Deeshk by Brandt.

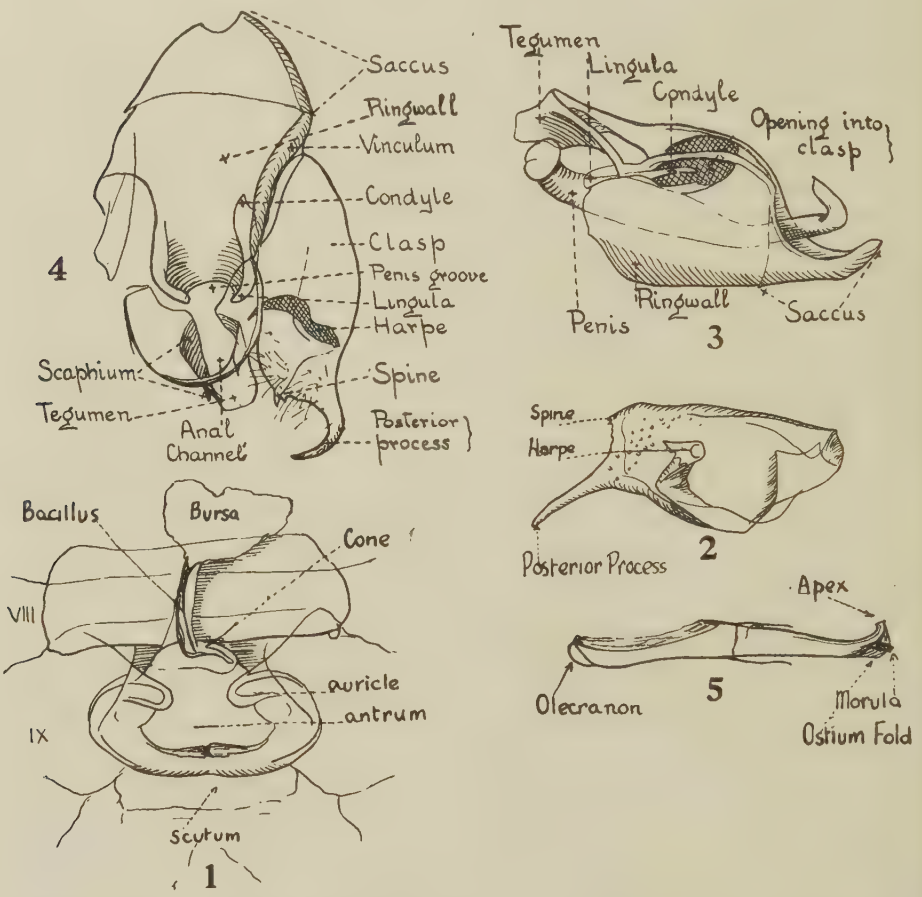


Fig. 198A.—1. *Melitaea didyma*, ♀ genitalia ; 2. do. ♂ clasp ; 3. do. ♂ genitalia, clasp removed ; 4. do. do. dorsal view ; 5. *Melitaea arcesia*, penis, lateral view.

1 *armoricana*

2 *meridionalis*

3 *neera*

4 *dalmatina*

5 *ambra*

6 *ambra*

7 *occidentalis*

8 *meridionalis*

9 *ambra*

10 *graeca*

11 *mauretanica*

12 *? latonigena*

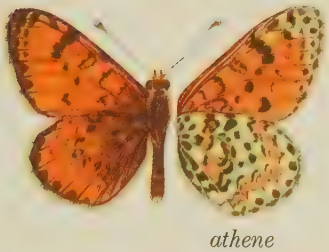
WATERLOW & SONS LIM

1

turkestanica

2

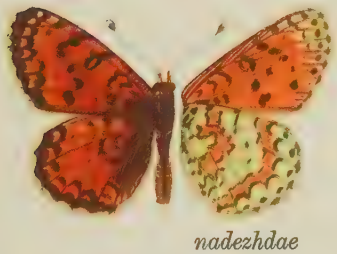
didymina

3 

athene

4

ala

5 

nadezhdae

6

mixta

7

perplexa

8

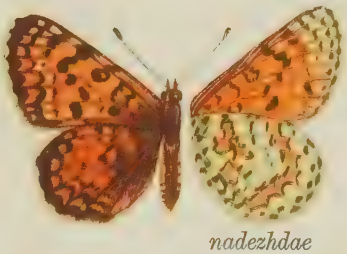
didymina

9

athene

10

ala

11 

nadezhdae

12

mixta

CATALOGUE OF PALEARCTIC *Melitaea*.

WATERLOW & SONS LIMITED

1

transcaucasica

7

transcaucasica

2

altaica

8

problematica

3

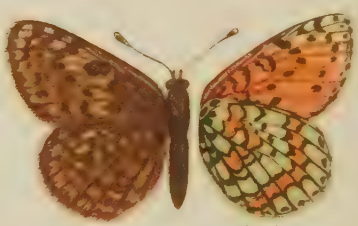
latonigena

9

latonigena

4

atrata

10 

atrata

5

polaris

11

polaris

6

sutschana

12

sutschana

WATERLOW &

Plate 1.

Fig. 1. *Melitaea didyma* mod. *armoricana* Ob. ♂. Vienne, Charroux.
2. *M. didyma* mod. *meridionalis* Stgr. ♂. Piedmont, Tenda, 2000 ft., 16.vi.1929.
3. *M. didyma* mod. *neera* F. de W. ♂. Ekaterinberg.
4. *M. didyma* mod. *dalmatina* Stgr. ♂. Mardin, Taurus.
5. *M. didyma* mod. *ambra* Higgins ♀. Dzungaria, 12.vi.1889.
6. *M. didyma* mod. *ambra* Higgins ♂. Amdo, 1890. ex Coll. Gr.-Gr.
7. *M. didyma* mod. *occidentalis* Stgr. ♀. Florence, 13.vii.
8. *M. didyma* mod. *meridionalis* Stgr. ♀. Piedmont, Tenda, 2000 ft.
9. *M. didyma* trans. ad mod. *ambra* Higgins ♂. "Mesopotamia."
10. *M. didyma* mod. *graeca* Stgr. ♂. "Caucasus."
11. *M. didyma* mod. *mauretanica* Ob. ♂. Yakouren, Algeria, vii./viii.1907.
12. *M. didyma* ? *latonigena* Eversm. ♂. Amdo, 1890. ex Coll. Gr.-Gr.

All specimens are in the author's collection.

Plate 2.

Fig. 1. *M. didyma turkestanica* Shelj. ♂ lectotype (*turanica* Stgr.). Marghilan, 25.vi.1880. ex coll. Staudinger (orig.).
2. *M. didymina* Stgr. ♂ lectotype. Uliassutai. Leder leg. ex coll. Staudinger (orig.).
3. *M. athene* Stgr. ♂ lectotype. Saisan. Coll. Staudinger (orig.).
4. *M. ala* Stgr. ♂ lectotype. Ala Tau. Coll. Staudinger (orig.).
5. *M. didyma mixta* mod. *nadezhdae* Shelj. ♂. Baroghil Pass, Hindukush, 3800 m.
6. *M. didyma mixta* Evans ♂ paratype. Chitral. Evans leg. Coll. Brit. Mus.
7. *M.* ? *didymina perplexa* n. ♀ type. Urumtchi.
8. *M. didymina* Stgr. ♀ neallotype. Uliassutai. ex coll. Staudinger (orig.).
9. *M. athene* Stgr. ♀ neallotype. No locality [Saisan]. Coll. Staudinger (orig.).
10. *M. ala* Stgr. ♀ neallotype. No locality. [Ala Tau]. Coll. Staudinger (orig.).
11. *M. didyma mixta* mod. *nadezhdae* Shelj. ♀. Baroghil Pass, Hindukush, 3800 m.
12. *M. didyma mixta* Evans ♀. Chitral.

All specimens are in the author's collection unless it is stated otherwise.

Plate 3.

Fig. 1. *M. transcaucasica* Turati ♂. Borjom, Transcaucasus.
2. *M. didyma latonigena* mod. *altaica* Gr. ♂. Altai Mts., Ongodai, 3500 ft., 7.vii.1898.
3. *M. didyma latonigena* Eversm. ♂. Kentei Mts. Coll. Brit. Mus.
4. *M. didyma latonigena* mod. *atrata* Higgins ♂. Eastern Sajan, Turkinsk Weissberge, 2000 m., July.
5. *M. didyma latonigena* mod. *polaris* Gr. ♂. Verchojansk, 4.vii.1901.
6. *M. sutschana* Stgr. ♂. Amur, Pokrofka.
7. *M. transcaucasica* Turati ♀. Borjom, Transcaucasus.
8. *M. didyma mixta* mod. *problematica* Shelj. ♂. Chitral, 7.vii.1928.
9. *M. didyma latonigena* Eversm. ♀. Kentei Mts.

Fig. 10. *M. didyma latonigena* mod. *atrata* Higgins ♀. East Sajan, Turkinsk Weissberge, 2000 m., July.
11. *M. didyma latonigena* mod. *polaris* Gr. ♀. Verchojansk, Jena Valley, 12.vii.1901.
12. *M. sutschana* Stgr. ♀. Amur, Pokrofka.

All specimens are in the author's collection unless it is stated otherwise.

Plate 4.

Fig. 1. *M. persea dodgsoni* Gr.-Sm. ♂. Mehtarzai Pass, Baluchistan, 7000 ft., 17.v.1931.
2. *M. persea paphlagonia* Fruhst. ♂. Arwas, Transcaspia.
3. *M. persea dodgsoni* Gr.-Sm. ♂. Small form. Urak, Baluchistan, 6.v.1929.
4. *M. montium* Belter ♂. Form. aest. Cedars of Lebanon, 19.viii.1897.
5. *M. persea hafiz* Higgins ♂. North Persia, 1884. Funke leg.
6. *M. persea* Kollar ♂. Persia, Dashtarjan, 6000 ft., 28.iv.1918.
7. *M. persea dodgsoni* Gr.-Sm. ♀. Mungha, Mehtarzai, Baluchistan, 19.v.1929.
8. *M. lutko mimetica* Higgins ♂ paratype. Khojak, Baluchistan, 11.iv.1931.
9. *M. montium* Belter ♀. Cedar Mountain, 23.vi.1930.
10. *M. persea* forma ♀. Form aest. Cedars of Lebanon, 28.viii.1897.
11. *M. persea* near *caucasica* Stgr. ♀. Marasch, Taurus, –.v.1933.
12. *M. pseudoala* Shelj ♂. Kasakstan, Aulie Ata, Talasalatau, 2500 m., July (type of *rosea* Higgins).

All specimens are in the author's collection.

Plate 5.

Fig. 1. *M. deserticola* Ob. ♂. Biskra, –.iii.1910. Faroult leg.
2. *M. didymoides pekinensis* Seitz ♀. Pekin. Stotzner leg.
3. *M. didymoides* Ev. ♂. Changai Mts. Leder leg.
4. *M. didymoides latonia* Gr. ♂. N. Kansu, Richthofen Mts., July, 3000 m.
5. *M. didymoides latonia* Gr. Damp climate form. S.E. Kansu, Min, Minschan Or., July, 3000 m.
6. *M. abyssinica* Ob. "Abyssinia," ♂ holotype. Coll. Brit. Mus.
7. *M. deserticola macromaculata* Belter ♀. Beyrouth. Form vern. Balint. leg.
8. *M. deserticola harterti* Roths. ♂. Sahara, E. Golea. Coll. Rothschild.
9. *M. didymoides* Ev. ♀. Kentei Mts.
10. *M. didymoides latonia* Gr. ♀. N. Kansu, Richthofen Mts., July, 3000 m.
11. *M. didymoides latonia* Gr. ♀. Damp climate form. S.E. Kansu, Min, Minschan Or., July, 3000 m.
12. *M. acreina* Stgr. ♂. "Fergana."

All specimens are in the author's collection unless it is stated otherwise.

Plate 6.

Fig. 1. *M. sutschana yagakuana* Mats. ♂. Anutschino, Ussuri.
2. *M. chitralensis enarea* Fruhst. ♂. Hissar Mts., Bokhara, June.
3. *M. chitralensis* Moore ♂. "Chitral."

1

dodysoni

2

paphlagonia

3

dodgsoni

4

montium

5

hafiz

6

persea

7

dodgsoni

8

mimetica

9

montium

10

persea

11

caucasica

12

pseudoala

CATALOGUE OF PALEARCTIC *Melitaea*.

WATERLOW & SONS LIMITED,

1

deserticola

2

pekinensis

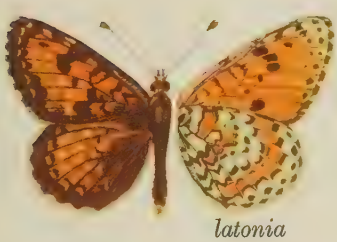
3

didymoides

4

latonia

5



latonia

6

abyssinica

7

macromaculata

8

harterti

9

didymoides

10

latonia

11

latonia

12

acreina

WATERLOW & SONS LIMITED.

1

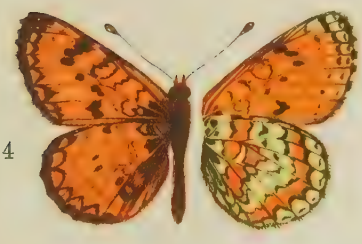
yagakuana

2

enarea

3

chitralensis

4 

? kotshubeji

5

ala

6

bicolor

7

permuta

8

permuta

9

chitralensis

10

? kotshubeji

11

ala

12

bicolor

CATALOGUE OF PALEARCTIC *Melitaea*.

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Trans. R. Ent. Soc. London, Vol. 91.

1 *lunulata*

7 *lunulata*

2 *maracandica*

8 *maracandica*

3 *fergana*

9 *shandura*

4 *fergana*

10 *fergana*

5 *ambrisia*

11 *ambrisia*

6 *infernalis*

12 *infernalis*

CATALOGUE OF PALEARCTIC *Melitaea*.

WATERLOW & SONS LIM

Trans. R. Ent. Soc. London, Vol. 91.

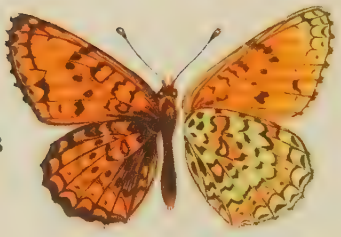
1 *saxatilis*

7 *saxatilis*

2 *sassanides*

8 *sassanides*

3 *evanescens*



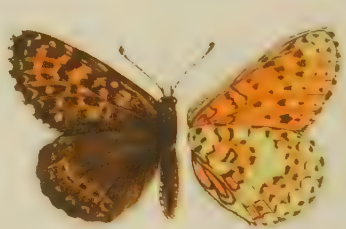
9 *arduinna*

4 *avinovi*

10 *fulminans*

5 *agar*

11 *agar*



6 *baileyi*

12 *baileyi*

CATALOGUE OF PALEARCTIC *Melitaea*.

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Fig. 4. *M. chitralensis* ? *kotshubeji* Shelj. ♂. "Samarcand." Coll. Brit. Mus.
5. *M. ala* trans. ad. *ala* Stgr. ♂. Thian-Shan.
6. *M. ala bicolor* Seitz ♂. Aulie Ata.
7. *M. chitralensis enarea* mod. *permuta* Higgins ♂. "Samarcand." Haberhauer.
8. *M. chitralensis enarea* mod. *permuta* Higgins ♀. "Samarcand." Haberhauer.
9. *M. chitralensis* Moore ♀. Chitral, 10,000 ft., vii.1910.
10. *M. chitralensis* ? *kotshubeji* Shelj. ♀. "Samarcand." Coll. Brit. Mus.
11. *M. ala* trans. ad. *ala* Stgr. ♀. Thian-Shan.
12. *M. ala bicolor* Seitz ♀. Karagatai Mts., S. Narynsk, Issyk Kul Merid., July.

All specimens are in the author's collection unless it is stated otherwise.

Plate 7.

Fig. 1. *M. lunulata* Stgr. ♂. Alexander Mts.
2. *M. fergana maracandica* Stgr. ♂ lectotype. No locality [South of Samarcand]. ex coll. Staudinger (orig.). Haberhauer leg.
3. *M. fergana* Stgr. ♂ lectotype. No locality [Alai Mts.]. ex coll. Staudinger (orig.).
4. *M. fergana* Stgr. ♂. Naryn.
5. *M. ambrisia* Higgins ♂ holotype. Marghilan. Coll. Brit. Mus.
6. *M. infernalis* Gr.-Gr. ♂ paratype. Boro-Choro Mts. Coll. Brit. Mus.
7. *M. lunulata* Stgr. ♀ lectotype. No locality. [Alexander Mts.]. ex coll. Staudinger (orig.).
8. *M. fergana maracandica* Stgr. ♀ allolectotype. No locality. ex coll. Staudinger (orig.).
9. *M. shandura* Evans ♂. Garagar, Chitral, 29.vii.1928.
10. *M. fergana* Stgr. ♀. Naryn. Coll. Brit. Mus.
11. *M. ambrisia* Higgins ♀. No locality. Coll. Staudinger (orig.). (Labelled *maracandica*.)
12. *M. infernalis* Gr.-Gr. ♀ paratype. Boro-Choro Mts. Coll. Brit. Mus.

All specimens are in the author's collection unless it is stated otherwise.

Plate 8.

Fig. 1. *M. saxatilis* Christoph ♂ paratype. Shahkuh, N. Persia, 14.vi.1871. ex coll. Christoph. Coll. Brit. Mus.
2. *M. saxatilis sassanides* Higgins ♂ type. Mt. Demavend, Elburz, 26.vi.1894. ex coll. Gr.-Gr. Coll. Brit. Mus.
3. *M. arduinna evanescens* Stgr. ♂. "Persia."
4. *M. arduinna avinovi* Shelj. ♂ paratype. Ishkashim, S.W. Pamirs. Coll. Brit. Mus.
5. *M. agar* Ob. ♂. "Ta-tsien-lu" [S.W. China].
6. *M. agar baileyi* Watkins ♂. Phe, S.E. Thibet, 9.vii.1913, 10,000 ft.
7. *M. saxatilis* Christoph ♀ paratype. Shahkuh, N. Persia, 14.vi.1871. ex coll. Christoph. Coll. Brit. Mus.
8. *M. saxatilis sassanides* Higgins ♀. Mt. Demavend, Elburz, N. Persia. allotype, ex coll. Gr.-Gr. Coll. Brit. Mus.
9. *M. arduinna* Esper ♂. East Turkestan, Fort Naryn, 1907.

Fig. 10. *M. arduinna fulminans* Stgr. ♀. "Samarcand."
11. *M. agar* Ob. ♀. "Ta-tsien-lu."
12. *M. agar baileyi* Watkins ♀. Dokar, S.E. Thibet, 10.viii.1913, 10,000 ft.

All specimens are in the author's collection unless it is stated otherwise.

Plate 9.

Fig. 1. *M. trivia* W.V. ♂. Bulgaria, Kostenetz, –.vii.1933, 3000 ft.
2. *M. trivia robertsi* Butl. ♂. Beirut, Syria.
3. *M. trivia tigris* Higgins ♂. Malakand, N.W. Frontier.
4. *M. lutko mimetica* Higgins ♀ allotype. Baluchistan, Ziarat Road, 20.iv.1931, 6500 ft.
5. *M. lutko* Evans ♂. N.W. India, Murree.
6. *M. romanovi* Gr.-Gr. ♂ paratype. Amdo, Hoang Ho. ex coll. Gr.-Gr. Coll. Brit. Mus.
7. *M. trivia pseudodidyma* Rebel ♂. Hadjin, Turkey, 3500 ft.
8. *M. trivia catapelia* Stgr. ♂. Hissar Mts. ex coll. Gr.-Gr.
9. *M. trivia catapelia* Stgr. ♀. Hissar Mts., 22.vii.1892. ex coll. Gr.-Gr.
10. *M. yuenty* Ob. ♂. Tsekou, Szechuan.
11. *M. romanovi* mod. *puella* Higgins ♀ allotype. Changai Mts. Coll. Brit. Mus.
12. *M. romanovi* Gr.-Gr. ♀ paratype. Amdo, Hoang Ho. ex coll. Gr.-Gr. Coll. Brit. Mus.

All specimens are in the author's collection unless it is stated otherwise.

Plate 10.

Fig. 1. *Melitaea cinxia tschujaca* Seitz ♂. Oulz, Piedmont, 2.vii.1929, 5000 ft.
2. *M. cinxia tschujaca* Seitz ♂. S.E. Altai (*H. J. Elwes*), 24.vi.1898, 4000 ft.
3. *M. cinxia* mod. *amardea* Gr. ♂. "Crimea." Probably second brood.
4. *M. cinxia amardea* Gr. Demavend, 20.vi.1894. Paratype ♂.
5. *M. cinxia clarissa* Stgr. ♂. Broussa; Asia Minor. No date.
6. *M. cinxia australis* Vrty. Florence. Paratype ♂. Brit. Mus. (N.H.).
7. *M. cinxia* forma *pallida* Tutt. ♀. Isle of Wight, England. Brit. Mus. (N.H.).
8. *M. cinxia* mod. *pallida* Tutt. ♀. Shahkuh, N. Persia. No date. Brit. Mus. (N.H.).
9. *M. cinxia cinxia* L. ♀. Kostenetz; Bulgaria, 14.vi.1933, 3500 ft.
10. *M. cinxia amardea* Gr. ♀. Demavend, 26.vi.1894. Paratype ♀.
11. *M. cinxia* forma ♂. Hami; N. Mongolia. No date. Possibly second brood.
12. *M. cinxia atlantis* Ob. Morocco, Grand Atlas Arround. Paratype ♂. Brit. Mus. (N.H.).

All specimens are in the author's collection unless it is stated otherwise.

Plate 11.

Fig. 1. *Melitaea collina* Led. ♂. Taurus Mts., Achyr Dagh, Marasch, v.1933.
2. *M. minerva sultanensis* Stgr. ♂. Alai Mts. June.
3. *M. minerva balbina* Tytler ♂ (topotype). Shahjenali, Chitral, vii.1928.
4. *M. minerva minerva* Stgr. ♂ (topotype). Ala Tau Mountains.
5. *M. minerva palamedes* Gr.-Gr. ♂. Gultcha, Pamirs.

1

trivia

7

pseudodidyma

2

robertsi

8

catapelia

3

tigris

9

catapelia

4

mimetica

10

yuenty

5

lutko

11

puella

6

romanovi

12

romanovi

WATERLOW & SONS LIMITED,

1

tschujaca

2

tschujaca

3

amardea

4

amardea

5

clarissa

6

australis

7

pallida

8

pallida

9

cinxia

10

amardea

11

cinxia forma

12

atlantis

CATALOGUE OF PALEARCTIC *Melitaea*.

WATERLOW & SONS LIMITED.

1

collina

7

collina

2

sultanensis

8

sultanensis

3

balbina

9

balbina

4

minerva

10

elizabethae

5

palamedes

11

palamedes

6

pallas

12

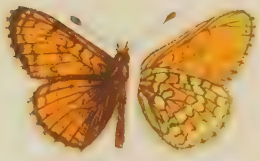
pallas

WATERLOW & SONS LIMITED,

1 *asteroida*

7 *asteroida*

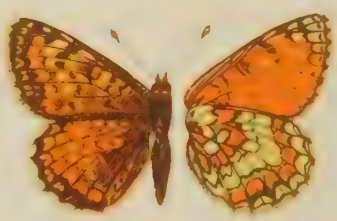
2 *clara*



8 *clara*

3 *turanica*

9 *turanica*



4 *hebe*

10 *balba*

5 *diamina*

11 *protomedia*

6 *vernetensis*

12 *wheeleri*

CATALOGUE OF PALEARCTIC *Melitaea*.

WATERLOW & SONS L

Trans. R. Ent. Soc. London, Vol. 91.

1

? vernetensis

2

arcesia

3

amoenula

4

sikkimensis

5

jezabel

6

balbita

7

regama

8

chuana

9

sindura

10

sikkimensis

11

balba

12

balbita

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Fig. 6. *M. pallas* Stgr. ♂. " Fort Naryn," " Semirechgensee." ex coll. Oberthur.
7. *M. collina* Led. ♀. Beyruth, Syria. No further data.
8. *M. minerva sultanensis* Stgr. ♀. Sarafschan. No further data.
9. *M. minerva balbina* Tytler ♀ (topotype). Shahjenali, Chitral, vii.1928.
10. *M. minerva elizabethae* Av. ♂ (paratype). Brit. Mus. (N.H.). ex Avinoff. river Tokus-bulak, 12,000 ft., 23.vi.1909.
11. *M. minerva palamedes* Gr.-Gr. ♀. Gultcha, Pamirs.
12. *M. pallas* Stgr. ♀. " Fort Naryn," Semirechgensee. ex coll. Oberthur.

All specimens are in the author's collection unless it is stated otherwise.

Plate 12.

Fig. 1. *Melitaea turanica asteroida* Stgr. ♂. Dsharkend, Semiretschensk. No further data.
2. *M. turanica clara* Stgr. ♂. "Kuldscha." No further data.
3. *M. turanica* Ersch. ♂. Hissar Mts., 17.vii.1892. ex coll. Gr.-Gr.
4. *M. diamina hebe* Borkh. ♂. Aschau; South Bavaria, 2000 ft., 19.vi.1930.
5. *M. diamina* Lang ♂. Interlaken, Switzerland, 4000 ft., 20.vi.1922.
6. *M. diamina vernetensis* Rond. ♂. Vernet-les-Bains, Pyren. Or., summer 1891. ex coll. Oberthur.
7. *M. turanica asteroida* Stgr. ♀. " Naryn River," Thian-Shan. No further data.
8. *M. turanica clara* Stgr. ♀. " Kuldja." No further data.
9. *M. turanica* Ersch. ♀. Hissar Mts., 17.vii.1892. ex coll. Gr.-Gr.
10. *M. minerva balba* Evans ♂. Chitral, 11,000 ft., 26.vi.1910.
11. *M. diamina protomedia* Mén. ♂. " Amur." No further data.
12. *M. diamina wheeleri* Chapm. ♂. Monte Generoso, 1200–1500 m. No date. Probably gen. II.

All specimens are in the author's collection.

Plate 13.

Fig. 1. *Melitaea diamina* ? *vernetensis* Rondou ♂. Asturias Mts., N. Spain, near Potes, 2000 ft., 2.vii.1935.
2. *M. arcesia arcesia* Brem. " Siberia." ♂. No further data.
3. *M. arcesia amoenula* Feld. ♂. Ladak, Khema, 16,000 ft. No date.
4. *M. arcesia sikkimensis* Moore ♂. Sikkim, Himalaya, " Hautes Alpes." No further data. ex coll. Oberthur.
5. *M. arcesia jezabel* (trans.) Ob. ♂. Yaregong, Thibet. No further data. ex coll. Oberthur.
6. *M. arcesia balbita* Moore ♂. Sonamurg, N.E. Kashmir. No further data. Capt. Read legit.
7. *M. diamina regama* Fruhst. ♂. Changyang, near Ichang, W. China. No further data. 1888. Pratt legit.
8. *M. arcesia chuana* Gr. ♀. " Amdo." No further data. ex coll. Gr.-Gr. " Original " label.
9. *M. arcesia sindura* Moore ♂. Yatung, Thibet. No further data.
10. *M. arcesia sikkimensis* ♀. Phari, Thibet, 19.vii.1924, 16,000 ft.
11. *M. minerva balba* Evans ♀. Chitral, 11,000 ft., June.
12. *M. arcesia balbita* Moore ♀. Togomshibu, Pamirs, vii.1928. No altitude.

All specimens are in the author's collection.

PLATE 14.

FIG. 1. *Melitaea phoebe ottonis* Fruhst. ♂. Simplon (mod. *monilata* Vrty), Berisal, 29.vii.1926.
2. *M. phoebe changaica* B.-H. ♂. Changai Mountains. No date.
3. *M. phoebe tusca* Vrty ♂. gen. II (*pauper* Vrty). Lucca, Tuscany, 300 metres, 7.viii.1920. (Querci coll.)
4. *M. phoebe enoch* ♂ Higgins. Askhabad, Transcaspia. No date.
5. *M. phoebe telona* Fruhst. ♂. Beyruth, Syria. No date.
6. *M. phoebe punica* Oberth. ♂. Lambessa; Algeria. v.1912.
7. *M. phoebe phoebe* W.V. ♀. Aschau, Prien, Bavaria, 22.vi.1930, 2000 ft.
8. *M. phoebe mandarina* Bang-H. ♀. Chi-feng-hsien, Chi-li, North China.
9. *M. phoebe aetherea* Eversm. ♀. Sarepta, S. Russia, 22.v.1914.
10. *M. phoebe ornata* Christoph ♀. Kisilokaja, Ural Mountains, v.1913.
11. *M. phoebe occitanica* Stgr. ♂. South Spain. No date. (1880.)
12. *M. phoebe nimbula* Higgins ♂. Espinama, Picos de Europa, 30.vi.1935.

All specimens are in the author's collection.

PLATE 15.

FIG. 1. *Melitaea scotosia* Butler ♂. Oiwake, Japan, vi.–vii.1887.
2. *M. scotosia butleri* Higgins ♂. "Mongolia." Male paratype. No further data.
3. *M. aetherie* Hb. ♂. Gibraltar, 10.v.1885.
4. *M. aetherie algerica* Ruhl ♂. Lambessa; Algeria, v.1912.
5. *M. sibina rama* Higgins ♂. Fort Narine, Semirechgensee, Turkestan, 1907.
6. *M. sibina sibina* Alph. ♀. Kuldscha; Turkestan. No date.
7. *M. scotosia* Butler ♀. Sutschanski, Rudnik, Ussuri.
8. *M. phoebe punica gaisericus* Hemming ♀. Azrou, Morocco. End June 1921.
9. *M. aetherie* Hübn. ♀. "Andalusia." No date.
10. *M. aetherie algerica* Ruhl ♀. Lambessa; Algeria, vi.1885.
11. *M. sibina* ? *aulicana* Bang-Haas ♀. Alexander Mts. No date.
12. *M. sibina* near *rama* ♀. Mount Shahkuh, North Persia, 10,000 ft. No date. ex coll. Elwes. E. Funke coll.

All specimens are in the author's collection unless it is stated otherwise.

PLATE 16.

FIG. 1. *Melitaea arcesia arcesia* mod. *chuana* Gr. ♂. "Kuku-Nor, Thibet." No further data.
2. *M. arcesia bellona* Leech ♂. Tse-kou, 1880.
3. *M. arcesia bellona* Leech ♀. "Thibet." No further data.
4. *M. pseudoala* Shelj. ♀. Aulie Ata, Talasalatau, 2500 m., July. (Allotype of *rosea* Higgins.)
5. *M. ambrisia alraschid* Higgins ♂. Type. "Persia."
6. *M. deserticola macromaculata* Belter ♀. Gen. *vernalis*. N. Ibrahim, Syria. 16.iii.1930. R. W. Ellison coll.
7. *M. arcesia arcesia* mod. *minor* Elwes ♂. Ongadai, Altai Mts., 1898.
8. *M. arcesia jezabel* Ob. ♀. Ta-tsien-lou, 1906.
9. *M. turkmanica* Higgins ♂. "Askhabad." Paratype. No further data.
10. *M. consulis* Wiltshire ♂. Shiraz, Persia, 8000 ft., 1.v.1940.
11. *M. abyssinica scotti* Higgins ♂ holotype. Aden Prot., Jebel Jehaf, Western face, 6600 ft., 6.x.1937.
12. *M. abyssinica scotti* Higgins ♀ allotype. Yemen, Jebel Kohl, 15 miles N. of Saria, 9500 ft., 1.ii.1938.

All specimens are in the author's collection unless it is stated otherwise.

1

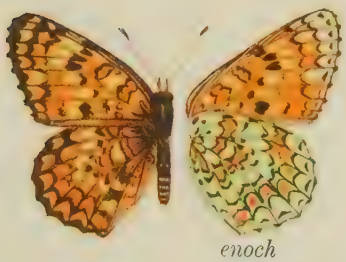
monilata

2

changaica

3

pauper

4 

enoch

5

telona

6

punica

7

phoebe

8

mandarina

9

aetherea

10

ornata

11

occitanica

12

nimbula

CATALOGUE OF PALEARCTIC *Melitaea.*

WATERLOW & SONS LIMITED,

1 *scotosia*

2 *butleri*

3 *aetherie*

4 *algerica*

5 *rama*

6 *sibina*

7 *scotosia*

8 *gaisericus*

9 *aetherie*

10 *algerica*

11 *? aulicana*

12 near *rama*

CATALOGUE OF PALEARCTIC *Melitaea*.

WATERLOW & SONS LIMITED.

1 *chuana*

2 *bellona*

3 *bellona*

4 *pseudoala*

5 *alraschid*

6 *macromaculata*

7 *minor*

8 *jezabel*

9 *turkmanica*

10 *consulis*

11 *scotti*

12 *scotti*

CATALOGUE OF PALEARCTIC *Melitaea*.

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